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# THE SCOTTISH GEOGRAPHICAL MAGAZINE

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# THE SCOTTISH GEOGRAPHICAL MAGAZINE

PUBLISHED BY THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY
PROFESSOR JAMES GEIKIE, LL.D., D.C.L., F.R.S., HON. EDITOR
MARION I. NEWBIGIN, D.Sc., ACTING EDITOR

VOLUME XXVIII: 1912

128 501
5/7/13

EDINBURGH
PRINTED BY T. AND A. CONSTABLE, PRINTERS TO HIS MAJESTY
AT THE UNIVERSITY PRESS
1912

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# THE SCOTTISH GEOGRAPHICAL MAGAZINE.

## BRITISH EXPLORATION IN DUTCH NEW GUINEA.

By Captain C. G. Rawling, C.I.E., Somerset Light Infantry.

*(With Illustrations.)*

An expedition, organised by the Ornithologists' Union and assisted by the Royal Geographical Society, left England in October 1909 for the south western coast of Dutch New Guinea, for the purpose of survey and to form collections of the fauna and flora of that district. As that portion of the island had never been previously visited, and as it lay in close proximity to the great central snow-clad range, it was hoped that many new species of mammals, birds, reptiles, etc., would be obtained. The expedition consisted of Mr. W. Goodfellow, a noted ornithologist, as leader, Mr. A. F. R. Wollaston, medical officer, botanist and entomologist, and Messrs. W. Stalker and G. Shortridge, assistant collectors. The survey section was represented by myself and Mr. E. Marshall as assistant surveyor and surgeon. We arrived at Batavia on December 1st, and were there joined by ten Gurkhas from Darjeeling. The Dutch authorities most kindly supplied forty Javanese soldiers and their necessary convict carriers, and transported the whole force to the mouth of the Mimika River, one of the only two known river mouths on the south western coast of New Guinea. Our own coolies had been recruited at Amboina, and later on when these broke down others were obtained from Boetan and Macassar. Neither the Javanese troops, their carriers, nor any of our followers, were of the stamp of man to withstand the climate of New Guinea. Our total losses by death reached 12 per cent., and those invalided out of the country 83 per cent. Of nearly four hundred men employed only eleven lasted out the expedition, and of these four were Europeans and four Gurkhas. As the Dutch have learnt from experience, no men of the Dutch East Indies except Dyaks,

are of any value as carriers in the western half of the island of New Guinea. On the morning of the 3rd January 1910 the coast was sighted.

Beyond the water-laden mist which completely enveloped the low-lying country to the foothills of the central range, fifty miles distant, rose line upon line of knife-edged forest-clad ridges, lying east and west and parallel to the main range, which stretches from one end of the island to the other, a distance of eleven hundred miles. The western section, known as the Charles Louis Range, throws out a great promontory southward to the sea. That portion lying north of the Mimika district, formerly called the Snowy Range, and in which are to be found the highest peaks in the island, will in future be known as the Nassau Range, to the east of which again comes the Orange Range with its high point of Wilhelmina Peak.

The Nassau Range rises steadily from the Charles Louis Range in the west, culminating on the east at its highest point, known as Carstensz Peak, 15,964 feet. On our arrival the whole range lay bare of cloud, the great glaciers of Carstensz clearly visible, together with three other snow peaks of slightly less altitude lying directly behind. To the west of Carstensz stretched a great snowfield, divided by a small rift from a three-peaked snow-clad mountain known as Mount Idenburg (15,379). Still falling slightly, but to the eye hardly noticeable, next came Mount Leonard Darwin (13,882), the south side of which forms the greatest sheer fall of any precipice in the world, but of this I will speak later. The snow-line is at about 14,500 feet. As the mist drifted and vanished an attempt was made to locate the Mimika, always a difficult task, for the mouth of one river is exactly like another, each having a group of casuarina-trees on either side of the entrance. Close steaming is an impossibility for, on account of the extreme shallowness of the water, no ship drawing over twelve feet can approach nearer than two to three miles of the shore. With the assistance of natives who came off in crowds to intercept the ship, and to whom the one word "Mimika" was sufficient guide, we were enabled to cast anchor off the river late in the afternoon of that day. The weather was fine, and the disembarkation of the men and stores was safely carried out during the three following days. This was fortunate, for the coast, on account of the rapidity with which storms arise, is a particularly dangerous one. From the middle of January to the middle of March, and again from the first week in June to the middle of October, the chances are very much against a landing being accomplished. During the former period the west monsoons are blowing, and during the latter period the east monsoons. In addition, a powerful tide is always running, and the bars across the rivers are continually changing. Every river has a bar, many uncrossable except at high tide, even for a launch. The Mimika always had five or more feet of water available. The tides apparently followed no law. Sometimes there were two tides of equal height, at other periods only one tide in the twenty-four hours, a great rise and a great fall often of fifteen to twenty feet, though by careful watching it was observed that there was a second tide of from six inches to a foot. The same trouble has been found down the coast. During a stay of three weeks at the mouth of the

FIG. 1.—A lightly built coast native with an uncommon head-dress.

FIG. 2.—Within the 12-mile belt of tidal waters. The banks of the Munika River.

Mimika in the month of December, high tide, and there was only one notable rise in the day, took place always between five and nine o'clock in the morning.

The natives (Fig. 1), men of splendid physique but of brutal countenance, showed great joy at our arrival. Only on one previous occasion had they seen white men, and then only for an hour or so, but the trade they had obtained must have been such as have made them long for the advent of the, to them, peculiar race who were willing to exchange steel axes for stone ones. Not until we had proceeded five miles up the river was a spot found upon which the base camp could be built.

The only available ground on the right bank was occupied by Wakatimi village, the site chosen for the camp consisting of a peninsula formed by the bend of the river facing the village. This we then believed was well above any possible rise of the Mimika, but such proved not to be the case, for in June the whole peninsula was flooded for three days to a depth of from two to six feet. The Mimika is tidal for six miles above Wakatimi, the natives shifting their temporary villages from river to river according to the amount of water descending from the hills.

Natives poured in to inspect us from all parts, showing no fear, but only a keenness to trade. Anxious as they were to obtain cloth, beads, knives, axes, etc., yet not a day's work could we ever get out of any of the coast tribes. The women do all the manual labour, and their time was far too fully employed for them to give any to our requirements. Fortunately they were willing to supply any amount of roofing for the huts, pandanus leaves being treated in a similar manner as in Java and elsewhere in the East. Canoes already in use they sold freely, a priceless asset to us, for no means of river transport had been imported into the country by the expedition. The natives refused to assist in poling or paddling our canoes up the river, for, as we afterwards learnt, the line of demarcation between the coast and up-river natives is very strictly observed, and the line at this place lies at the head of the tidal waters. After several attempts, the village of Parimau, at the headwaters of the Mimika, was reached. Six marches separated it from Wakatimi. The people (Fig. 3) were of similar build and not to be distinguished from the coast people except that they were of pleasanter countenance and better workers. The Wakatimi natives had proved themselves a drunken, swashbuckling crew, always ready for a brawl, and perpetually excited by copious draughts of the potent beer of the sugar palm. The Parimau men were unable to obtain alcohol on account of the absence of palms, and this may account for their more orderly disposition. This is only used in a comparative sense, for the people fly to arms on the slightest provocation, men and women alike. An individual quarrel is taken up by the whole village, in less than a minute a scene of quiet and peace being turned into a pandemonium. The weapon chiefly favoured is the stone club, at least one of which is always standing by the doorway ready for instant use. I saw no people actually killed in the broils, but many badly injured: care is always taken to avoid striking the head.

Parimau, although thirty miles from the coast in a direct line, is situated at a height of less than a hundred feet above sea-level. The intervening country was covered with a dense growth of Pandanus (four species), Artocarpus (three species), Eriodendron, *Albizzia Moluccana*, Ficus (many species), *Sagus rumphii*, and *Octomeles Moluccana*, together with Rattans (Calamus) of three or four species, and the scarlet flowering creeper *Mucuna pruriens* and the wild *Vanilla planifolia*. Underfoot the land was boggy, and during the heavy rains almost impassable. Such is the vegetation which extends over the whole of south-west New Guinea from the bare rocks of the central range to the sea. At intervals of from four to six miles, the land is intersected by great rivers, none of which are fordable, except on rare occasions, until the mountains are reached. The majority have their sources in the highlands to the north at about S. lat. 4°, the remainder rising in the low-lying jungle, and kept replenished by the constant rain. On entering the plains, the beds change from stone to mud, the course continually shifting as the dams of timber block the flow of the waters. The difficulty of cross-country movement cannot be exaggerated. Not only do the greater rivers render a crossing a dangerous and uncertain proceeding, but endless smaller streams, many waist-deep, add to the portage difficulties. Communication is maintained between the Kaparé, Mimika and Tuaba rivers by a single faint trail marked by the men breaking the twigs as they pass along. At the Tuaba River the track ceases, the country to the east being uninhabitable on account of the denseness of the forest and the excessive hardness of the timber. For this very reason, pig, wallaby and cassowary here find a sanctuary, from whence the more depopulated hunting districts are restocked. Flesh, however, forms but a small item in the diet of the natives, their chief and practically only food supply being sago and fish. Bananas and pumpkins are sometimes grown, but only in limited quantities, for their cultivation requires a certain amount of labour, to which the Papuan is adverse. Many individuals grow tobacco, to which all natives are very partial.

For many months attempts to penetrate into the hills met with little success. Stores had first of all to be accumulated at Parimau, the up-river station, a feat of great difficulty, as the imported coolies were limited in numbers, rapidly fell sick, and were much impeded by the varying conditions of the Mimika. None were available for cross-country transport, and the exploring party was forced to rely entirely upon what assistance could be obtained from the natives. These, however, proved most unreliable, on several occasions deserting when many marches from home and leaving us to get back the best way we could. Again, they refused to enter the hills, partly because they were not allowed to cross the line of demarcation between their own and the pygmy tribes who inhabited the lower mountains, and partly from fear of spirits or the hills themselves. The earliest attempt at exploration brought us out on to the Kaparé, a great river flowing to the west of the Mimika, and it was here that the first men of the pygmy tribe of Tapiro were run down and captured. The plainsmen were again successful in capturing two more a short time afterwards, and though

Fig. 3.—A family of up-river Papuans, Mimika District.

Fig. 4.—The Tuaba River, one march out from Parimau.

terribly frightened they were treated with such kindness that we were able, later in the year, not only to trade with them, but to visit and stay in their village of Wambirimi, situated on the southern slope of the low-lying hills and at a height of eighteen hundred feet above sea-level.

I have already given a detailed account of this new race of man to the Royal Geographical Society, and hope to amplify it shortly. They are without doubt of the same original stock as the ordinary Papuan, but distinct in dress, habitat and customs. Sufficient to state that they are well formed and nourished, with an average height of 4 feet $8\frac{3}{4}$ inches, while their neighbours living within ten miles average 5 feet $6\frac{3}{4}$ inches. I am inclined to believe that the average height of the pygmies will be found to be rather below what I have given, for though about thirty-three were measured it stands to reason that only the bolder, and therefore the men of the best physique, would come forward to risk the terrors of the measuring rod and the craniometer.

It was soon seen that no advantage would be gained by forcing a passage due north by the valley through which the Kapare flowed, for besides the difficulty of clearing a path along the almost precipitous sides of the valley, the only goal to be reached would be the foot of the great precipice lying twelve miles to the north, and many marches to the west of the snows. This line was therefore abandoned and a path cut eastward to the Tuaba, a great and often impassable river. An advance by this waterway was likewise purposeless, and the line was continued across to the Kamura, then for two marches up its bed and on to the Wataikwa. In addition to the want of transport, the expedition was much hampered by torrents of rain and flooded rivers and jungle. So great were these rivers that the line of communication was liable to be cut for days at a time, an awkward event in a country where local food supplies are *nil*.

All forward work was done entirely by the Europeans, Gurkhas and those few natives who could be induced to work. In addition to the total breakdown of the imported labour on two occasions, the steam-launch lent to us by the Dutch authorities and the motor-boat bought in June, were quickly rendered useless, the former on account of its not being of sufficient power to draw canoes against the current, the latter by being wrecked when returning down the river during a flood. All supplies had therefore to be man-hauled up the river, an operation which had no end. Progress was consequently extremely slow, as, in addition to the cutting parties, two collectors and their staffs had to be at the same time maintained in the field. Goodfellow was forced to leave the expedition in the early part of October suffering from fever and beri-beri, and Shortridge in November. Mr. C. Grant, who had arrived in the country in July, was now the sole representative of the collecting section, for Mr. W. Stalker had lost his life in the forest soon after landing. From Goodfellow I took over command.

During the months of July and August the road was pushed on to the Iwaka, a deep and rapid river four marches to the east of Parimau, and in the direct line to the snows. At the same time the clearing at

Parimau was being regularly worked at, fourteen acres being finally cleared in five months, and a fine view obtained of the whole of Carstensz and its neighbouring ranges, their positions fixed and heights obtained, including a new snow-capped mountain, now called Mount Idenburg, after the Governor-General of the Netherlands India.

No further progress with the exception of sundry journeys into the hills could be undertaken until the arrival of fresh coolies from Macassar. These arrived on December 23rd, but were most disappointing from the point of view of physique and carrying power. Within two months more than half of these were on the sick list and had to be invalided out of the country. Three months' stores were now rapidly accumulated at Parimau. From thence one hundred and ten loads were collected on the Wataikwa. It was necessary to move in two, and on one occasion, in three parties, relays being the most economical way to accumulate stores at the front, while at the same time carrying on the work. Marshall and Grant therefore moved first, carrying a certain amount of stores to the Iwaka, and then continuing the path up the right bank of that river for two marches in a search for a crossing place, and there formed a fresh base camp. In this search they were not successful, for the river showed no signs of diminishing in volume, was found to run from the north and not from the east as we had hoped, was unfordable anywhere, and too broad for a felled tree to form a temporary bridge. On Wollaston's and my arrival, ten days' food supplies were in hand; the river had been well prospected to the north, and it was evident that a crossing had to be made by some means or other.

Our intention was to reach the summit of a range of hills which formed an almost complete circle, and from whence a full view of the snows and main range might be obtained. As I said before, but ten days' supplies were in hand, and if this object was to be obtained an immediate move was imperative. Fresh efforts were made to fell trees across the river, but all attempts proved fruitless. Large trees were scarce, and those which fell correctly either broke their backs or were at once swept away by the current.

Late that night, however, luck changed, and the Gurkhas succeeded in felling one tree which held long enough for a single strand of rattan to be drawn across and fixed in position. In two days more, thanks to the pluck and cleverness of the Gurkhas, the bridge was complete. An immediate advance was made to the east, for only eight days' supplies remained. We were now on a branch of the Wania River, and up this new bed we advanced for two days. On account of the roughness of the road and the denseness of the vegetation slow progress was made, so slow in fact that it was soon realised that by this route the summit of the range could not possibly be reached with the amount of provisions still in hand. We therefore cut up a spur lying directly to the east, reached a height of 3000 feet that night, and the summit of the hill (5500 ft.) the day following. The going underfoot was such as we had never before experienced, for so dense was the mass of live and dead timber, that the path had to be made over and through the forest, solid

Fig. 5.—Wataikwa Mountain, 9000 ft., as seen from a height of 3000 ft. Precipice in cloud behind.

Fig. 6.—The main street of Wakatimi opposite the base camp.

ground not being found that day or the next, when a small party advanced along the crest. At the greatest height (6000 ft.) a fine point of observation was found, but on account of the clouds which early collected no view could be obtained. Rations were again reduced to a minimum and a fresh attempt made the following day. We were well rewarded. To the south lay the interminable plain without a break, except where the shining waters of the greater rivers appeared and vanished in the dense forest. Not a lake or a treeless swamp lay in the whole hundred miles from the Charles Louis Mountains in the west to the furthest point beyond Carstensz in the east and to the coastline fifty miles away. Along the foot of the lower hills lay that belt of forest some five miles in width through which we had had so much difficulty in cutting a path across to the Iwaka. There the rate of progress, with an average of five men at work a day, had been no more than three hundred yards in the twenty-four hours, the average falling some days to a bare one hundred and fifty yards. And then, when completed, the road had to be abandoned and a fresh line cut, for the going was such as to render it impracticable for coolie transport. To the east lay the great mass of Cocks Comb, its three equal points showing clear against the sky. Beyond and to the north lay the wild southern slopes of Carstensz. Directly behind to the north-west rose Mount Godman and Wataikwa Mountain (Fig. 5) and the great ridges running from the north. But grander than all was the main backbone of the Nassau Range. From Carstensz in the east to Mount Leonard Darwin, and beyond that again to the west, but with a dwindling altitude, lay a great precipice, eighty miles or more in length, seamed with cracks and fissures, but, to the eye, unclimbable. The greatest sheer height measured with the theodolite showed six thousand five hundred feet, but we were never in a position to use that instrument when the foot and the summit were visible at the same time. The greatest vertical height is Mount Leonard Darwin itself, and here it is little less than ten thousand feet, or about one and three quarter miles. It appears to consist of hard limestone, the strata being clear and distinct. The dip is at an angle of twenty-five degrees to the north, and as no higher mountains were seen beyond, and as the south-flowing streams take their rise from the precipice, there is little doubt that the main water parting between north and south Dutch New Guinea is along the summit of this precipice. The mountains to the south are much broken, and so covered with vegetation that the strata can be but seldom seen. An outcrop of slate with perpendicular strata exists in the bed of the Iwaka nineteen miles to the south, and close by is a quantity of clay. Seams of coal, varying in width of from four to eight inches, and strong evidences of petroleum, were also found in the same neighbourhood. A few miles below granite boulders lay scattered about the river beds, together with iron ore, and tin in small quantities. There were no signs whatever of the presence of gold. However rich the country may be in these metals, the climate is such that the cost of imported labour to work them is prohibitive. No local labour is available, no food supplies, and no local means of transport. The rainfall alone is such as to render the country practically uninhabitable. No high ground being available, the natives are forced

to camp on whatever may be at that time the ground least threatened by the floods. This accounts for the fact that there are no permanent buildings in the whole district. Parimau was on three separate occasions washed out of existence, the natives saving themselves and their goods in their canoes. The village behind the Wakatimi base camp was completely destroyed in June and not rebuilt. The rivers alter their courses and beds almost daily, and to such an extent that permanent bridging would soon be rendered useless.

From the furthest point reached, that is to say, eleven marches from the up-river camp of Parimau, a distance which had taken six weeks to cover, we retired on February 14th, 1911, accomplishing the return journey in six days, for food was short, the road cut, and all were only too anxious to leave the country now that the work was accomplished. Clearly had it been shown how impossible was the task of reaching the snows with the Mimika as the line of communication. Instead of being able to follow the natural lie of the country we had been forced across the great rivers, rivers capable of cutting one's communication with the base for weeks at a time, always difficult to cross, often dangerous, and sometimes impassable. While Marshall and Wollaston were making one further attempt to obtain a view of the pygmy women, and doing their best to overcome the scruples of the men, a task in which they were not successful, I proceeded to Wakatimi, and with the assistance of the motor-boat, which was, after much work, made to float and move, explored the next great river to the east.

The Kamura was found to have two mouths, several miles apart, and carrying an equal volume of water. The west branch, known as the Atoeka, empties itself directly into the sea, the east branch, the Kamura, into a bay some six miles in length, and two to three in width. Into this latter bay also flows the Wania, called by the coast tribes the Wandia, probably the greatest river between the Mimika and the Oetakwa. The Oetakwa was last year partially explored by Lieutenants Van der Bie and Postema by order of the Netherlands Government. It flows directly from Carstensz, and is of sufficient size to allow of a ship crossing the bar and proceeding for seventeen miles up the river. From this spot a launch can proceed for two days, and again canoes for still one more march. From this point the expedition pushed on for seven marches, when the members were forced to abandon the attempt to reach the snows.

But to return to the Kamura. The bifurcation takes place about fifteen miles from the coast by river, the main stream above being fed by the Tuaba, Kamura, Wataikwa and Iwaka rivers. These rivers are navigable for launch and canoe to the edge of the foothills.

Two large villages were found, of the same names as the rivers, the Atoeka and Kamura, both situated beyond the tidal waters. Atoeka is in fact the largest village in these parts, consisting of about six hundred huts with a population of from two thousand to two thousand five hundred, and with tobacco and cocoanut plantations round about. The people are similar in almost every respect to those met with on the Mimika. Not so the Kamura tribe, with their two hundred and

fifty huts and one thousand to fifteen hundred souls. The latter are of a decidedly lower type, of heavier build, and with more brutal countenances. Many of the men and several of the women were entirely nude. Only a short stay was here made, for the people were bent on plunder.

A further attempt was made to explore the Wania when Marshall and Wollaston reached Wakatimi from Parimau, the latter place having been abandoned to the natives. In this we were not successful, the motor-boat losing her propeller in a storm. Little need be said of this trip, for the results, though decidedly exciting and unpleasant, were not of geographical interest. The journey took six hours out and six days to return, the party being extremely lucky to escape with their lives. We had been in a heavy storm on a lee shore, surrounded by foam-covered reefs, in a sea teeming with sharks, and only held by an old rope and light anchor. Had the boats swamped, or had anything given, it was certain death for the three of us, together with our seven men.

The whole coast is a most dangerous one, on account of the shallowness of the water and the rapidity with which storms arise. On several occasions relief ships arrived off the coast, and were forced to depart without landing their stores or being able to take away the invalids. None of the ships, each of which drew from twelve to fourteen feet of water, could approach nearer than two and a half miles from the shore. This, together with the fact that every river has a pronounced and ever-moving bar, renders the south-east coast too dangerous for regular navigation.

On April 5, the gunboat *Mataram* and the marine ship *Zwaan* appeared off the coast, and by these we sailed for Amboina. Here the expedition broke up, Cramer and his men destined for Java, our coolies for Macassar, the Gurkhas for Darjeeling, and we four for England. The Javanese soldiers had proved invaluable in guarding Wakatimi and Paramau during our long absences in the mountains, and when encamped on the rivers to the east and west: and Lieutenant Cramer, the leader of the escort, and the only European who had remained with us from the beginning to the end, had filled a difficult *rôle* with much ability, tact, and success. Of the Gurkhas I must specially mention Mahesur, Jangbir, and Harkajit.

To sum up the final results of the expedition: large and valuable collections of birds, mammals, reptiles, butterflies and moths had been formed, together with botanical and ethnographical specimens: a new and unknown race of pygmies discovered, studied, measured, and photographed: a range of mountains, containing the greatest precipice in the world, together with three thousand square miles of country, surveyed and mapped, new snow-mountains found, and many great rivers explored: and a long stretch of coastline surveyed. We had accomplished the longest cross-country journey ever undertaken in Dutch New Guinea—*i.e.* eleven marches from the up-river camp—had proved the impossibility of the Mimika River as a line of advance to the snows, and on the other hand the value of the great rivers to the east if the same goal is intended.

# NOTES ON THE GEOGRAPHY OF THE EDINBURGH DISTRICT.

By James Cossar, M.A., F.R.G.S.

(*With Illustrations.*)

*Continued from* vol. xxvii., p. 654.

## Communications.

While it must be supposed that the roads within the Edinburgh district, leading to the capital city of the country, the seat of Parliament and the Courts of Justice, were superior to those in other parts of the kingdom, yet even as late as the middle of the eighteenth century they were far from satisfactory and sometimes must have hindered rather than encouraged communication. Few were fit for wheeled traffic, and even at that period the farmers in the neighbourhood of the capital had to convey their produce to market on horseback. For a horse to carry a load of two cwts. of coal for a distance of four miles from the pit was regarded as a hard day's work; the journey between Edinburgh and Haddington in a coach and four occupied the whole of a winter's day. Creech quaintly remarks that it was then common for people to make their will when setting out on a London journey: this is scarcely to be wondered at since, according to an Act of 1754, "the roads had become so bad that travellers cannot pass thereon without great danger. . . ." But with the national revival in the second half of the eighteenth century this state of matters was speedily altered: this was rendered the more necessary by the rapid development in the West of Scotland, and the rise of many mining and manufacturing centres throughout the Midland Valley after the Industrial Revolution. For the improvement of the existing roads and the construction of new ones few regions were more favourably situated than the Edinburgh district, especially after the adoption of the methods of road-building of Macadam and Telford. The igneous rocks so widely distributed throughout the region were found to be eminently suitable for road-building, and thus quarries have been opened in almost all the intrusive masses throughout the district in order to supply not only the local needs but also the demand from distant areas. Many of the streets of London are paved with material exported from the Edinburgh district.

The rapid expansion of the capital itself during the last quarter of the eighteenth century gave rise to several important improvements in the means of communication. Originally confined by its city wall to the narrow ridge or tail that runs eastwards from the bold crag on which stands the protecting castle, the population now extended along the parallel ridge to the north, separated from the old town and the castle by the morass of the Nor' Loch, and across the intervening valley

and ridge on the south side. Thus the configuration of the capital called for special methods of linking up the growing suburbs with the city itself, and of providing adequate channels of communication for its increasing commerce. A scheme that created much interest at the time was to throw a mound of earth across the morass to the north of the castle and thus to connect the new town with the old. The material required for this purpose was derived from the excavations of the new town, and within three years a road was made passable for carriages, an achievement referred to by a contemporary as "unrivalled by any but Alexander the Great's at Tyre." A century later it became necessary to tunnel this structure when the railway was carried along the valley occupied by Princes Street Gardens. Some years before the mound was built a bridge had been erected across the valley farther to the east, and a second bridge was built in later years by the railway company. The deep valley running along the south side of the castle rock and the ridge of the old town was also spanned by two bridges, and a direct and level road was established towards the south. Another bridge was erected in the beginning of the nineteenth century leading out of Edinburgh to the east. In addition to these bridges, made necessary by the action of geological processes in past ages, others were required across the Water of Leith to facilitate communication with the west and north-west, especially with the ferry at South Queensferry. These bridges are of interest to the student of sociology as well as to the geographer, for, as Robert Louis Stevenson has pointed out, they form a dividing line in the social strata of the capital.

The Edinburgh district is now traversed by a network of excellent roads converging upon the capital. The influence of the topography of the region upon the character and direction of these roads is very marked. Thus the road from Edinburgh to Dumfries first runs due south for several miles, but on reaching the south-east side of the Pentland Hills turns south-west and runs along their base. In the neighbourhood of the Carlops the road attains an elevation of over 900 feet. The road connecting the capital with the towns in the upper valley of the Tweed follows the valley of the South Esk for several miles, and then crossing the low pass between the Moorfoot and the Lammermuir Hills descends to the valley of the Gala Water. The road from Edinburgh to Coldstream crosses the Roman Camp ridge at a height of 550 feet, but rises considerably higher in traversing the Lammermuir Hills. A road that was of great importance in former times runs along the base of the northern Pentland slopes and across the bleak Carnwath Muir to the upper valley of the Clyde. This old Lanark road may have existed in Roman times, and certainly Roman remains are to be found along its route, but it was in the old coaching days that the highway attained its greatest importance: to-day it is practically deserted beyond Balerno, for the railway that runs parallel to it has now diverted most of the traffic that formerly passed along it. Between this road on the north side of the Pentland Hills and the Biggar road on the south there is practically no means of communication for wheeled traffic, but the transverse passes and low cols furnish easy

pedestrian routes. The suggestion to provide a direct route between Tweeddale and the Lothians by constructing a road through the low gap of the Cauldstane Slap, between the East and the West Cairn Hill, across the divide between the headwaters of the Lyne and the Water of Leith, was never carried out, but this route was much frequented for many years by drovers on their way from the valley of the Tweed and Liddesdale to the great tryst or fair that used to be held at Falkirk.

The influence of the configuration of the district is well illustrated in the contrast between the roads running from north to south and those from east to west. Thus the road from Edinburgh to Stirling nowhere exceeds an elevation of 350 feet, and the coast road from Edinburgh to Dunbar does not rise above 150 feet throughout its course of 35 miles, while between Portobello and Prestonpans, where it leaves the region, it maintains an almost uniform level of 40 feet above the sea.

Edinburgh is connected with Glasgow by three main roads, each running through important agricultural and mining centres. The most direct route passes through Broxburn and Uphall to Bathgate, Coatbridge, and Airdrie: the gradients throughout are comparatively slight, although the road rises to about 650 feet between Bathgate and Airdrie. The second road is about three miles longer, but it also connects several important centres—Kirkliston, Winchburgh, Linlithgow, Polmont and Falkirk: and by traversing the low border plain and the carse land of the Forth, and then following the valley of the Kelvin, this road maintains a lower level than the first, its highest point of 330 feet occurring where it crosses the igneous rocks in the parishes of Ecclesmachan and Linlithgow. The third road runs through Midcalder and Livingston, crosses the bleak Muir of Shotts at a height of over 700 feet, and then descends to the valley of the Clyde, passing through Mossend, Bellshill, and Uddingston before it reaches Glasgow.

With the advent of the motor-car both for pleasure and commercial purposes the roads of the country have regained something of their former importance. Most of the smaller centres of population, especially in the mining districts, are now linked up by a regular motor service for goods and passengers, and are in this way brought into closer touch with the capital: a motor mail service is maintained between Edinburgh and Glasgow.

The motor-car traffic has also revived the importance of the ferries across the Forth. Reference has been made to the passage at Queensferry, on the main route to Dunfermline, one of the ancient capitals of the country. A ferry between Kinghorn and Newhaven was superseded towards the middle of last century by the passage from Granton to Burntisland, which continued to be a very important highway to the north until the last decade of the century. Although it is no longer the connecting link between the railway systems on either side of the Forth, it is of increasing importance for the transport of motor-cars.

Among the other means taken to extend and improve the communications between the capital and the West of Scotland was the construction

of a waterway from Edinburgh to Falkirk to join the Forth and Clyde Canal. The Union Canal (indicated by a dotted line on the map of the hydrography) follows a very winding course, and makes a wide detour between Edinburgh and Winchburgh, which increases the actual distance between Edinburgh and Falkirk by about seven miles. By adopting this sinuous course, however, it has been possible to maintain the level of the waterway and to dispense with locks throughout the first thirty miles of its course. The canal traverses a rich agricultural region and passes several considerable centres of population, such as Slateford, Ratho, Winchburgh, Broxburn, and Linlithgow, and it might be expected that the canal would form an important channel of communication between these places and the capital. But from its completion in 1824 it appears to have met with but little success, and certainly when it was taken over by the railway company in 1849 its revenue was insufficient to provide a return to the shareholders for their capital. The income has decreased from £7260 in 1888 to £2310 in 1905, and the canal has practically fallen into disuse. A few tons of coal, stones, manure and bricks are being carried each year, but the total tonnage does not exceed 100,000. The greater mobility of the railway system, the cheaper freights which it gives for short distances, and the impossibility of sending small quantities of goods by canal have all tended to direct the traffic to the railway.

The first railway to be opened for traffic within the district was the short line between the Dalkeith coalfield and the capital. It was inaugurated in 1831 and was worked by horse traction until 1845. Ten years later a line was opened between Edinburgh and Glasgow, and in the same decade the Edinburgh and Bathgate railway was laid down. A short line from Edinburgh to its ports at Leith and Granton acquired great importance after 1847, when the line from Burntisland to Perth was opened: loaded trucks could then be shipped at Granton and transported to the opposite shore without unloading and reloading. Subsequently two main lines were opened which established communication with the southern part of the country: the one following the coast through East Lothian and Berwickshire: the other following the valley of the South Esk, the Gore Water and the Gala Water, and bringing the capital into direct communication with the woollen manufacturing towns and with Carlisle. The Pentland Hills are encircled by two lines of railway which meet at Carstairs: the one line runs along the south side of the hills to Leadburn where it branches to Peebles and West Linton: the other runs along the northern side of the Pentlands to Carstairs where it meets a branch from West Linton. The extension of the railway facilities within the immediate neighbourhood of Edinburgh has proved an important factor in the development of the surrounding villages—partly by making them popular residential quarters, and partly by affording easy access to the markets of the capital.

As in the case of the roads, the direction of the railways has to a large extent been determined by the configuration of the region. In some cases the relief has facilitated their construction—for example, the long level tract between Edinburgh and Gogar to the west, and the

low relief between the capital and Tranent on the eastern side. In other cases steep gradients could not be avoided, for example, on the line crossing the Moorfoot Hills to Galashiels, where only the most powerful engines can dispense with the services of the pilot in ascending the slope from Borthwick to Tynehead; between Inverkeithing and North Queensferry there is a gradient of 1 in 70 for over a mile and a half. The geological structure of the district has also been an important factor in laying the railways, for frequently it has been found necessary to cut through or to tunnel the igneous rocks and anticlinal folds that extend across the district. The volcanic rocks of the Calton Hill have been pierced for over a quarter of a mile, and extensive boring was also necessary through the Ferry Hills and in the neighbourhood of Philipstoun. But the most remarkable achievement in railway construction was the building of the Forth Bridge (Fig. 3) which was opened for traffic in 1890, and was the means of bringing the capital into direct connection with Perth and Inverness on the one hand, and with Dundee and Aberdeen on the other.

## Distribution of Population and Occupations.

The population of Midlothian at the recent census amounted to 507,662 persons; that of Linlithgow to 79,456. At the date of the first official census the population in each case amounted to 122,597 and 17,844, but, as the following table shows, the rate of increase has been irregular.

*Decennial Increase per cent. of Population.*

| | 1801-1811 | 1811-1821 | 1821-1831 | 1831-1841 | 1841-1851 | 1851-1861 | 1861-1871 | 1871-1881 | 1881-1891 | 1891-1901 | 1901-1911 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Midlothian, | 21·2 | 28·8 | 14·5 | 2·8 | 15·1 | 5·6 | 19·8 | 18·5 | 11·6 | 12·7 | 3·9 |
| Linlithgow, | 9·0 | 16·6 | 2·7 | 11·0 | 12·1 | 28·2 | 6·0 | 6·2 | 21·4 | 24·4 | 20·9 |

Between the distribution of the population throughout the region and the factors of relief, geological structure, and climate, there is a very intimate connection, and the maps showing these different phenomena should be compared from this point of view. Especially notable is the control exerted by the Pentland Hills. The contrast in the vegetation presented by the northern and the southern slopes of the hills has already been noticed; a similar difference exists in the distribution of population. On the northern slope the small village of Little Vantage is the only centre that reaches the 900-feet contour; but on the opposite side of the hills Silverburn, Eight Mile Burn, Nine Mile Burn, Walston, and Carlops are all situated at this altitude.

Along the coast are a number of villages whose inhabitants are engaged in fishing and its dependent industries, in the extraction of salt

from the brine of the sea, or in shipbuilding—for example, at Prestonpans, Musselburgh, Fisherrow, Joppa, Newhaven, Charlestown, and Inverkeithing. Still more important are the trading centres which furnish an outlet for the resources of the hinterland and an inlet for the necessary foodstuffs and raw material—Leith, Granton, and in addition to some of the small centres just mentioned, Bridgeness, Queensferry, and St. David's. The influence of the sand deposits along the coast in developing pleasure resorts has already been noted, and to this circumstance Portobello, Musselburgh, and Aberdour owe much of their prosperity.

The control exerted by the river courses upon the distribution of population is very marked. Thus Lasswade, Polton, Roslin and Penicuik on the North Esk; Slateford, Colinton, Juniper Green, Currie and Balerno on the Water of Leith, are thriving centres of industry for which the streams supply much of the power. But several of these places owe part of the recent development to the fact that their picturesque situation has made them favourite residential quarters for many members of the commercial and professional community of the capital.

Then scattered throughout the lowland district are many small agricultural communities with their centrally situated market towns, such as Edinburgh, Dalkeith, and Linlithgow. Except in the case of these towns such communities do not give rise to any considerable density of population. But the case of the mining communities is quite different. Wherever the conditions have proved favourable for working the minerals considerable centres of population have sprung up within comparatively recent times and within a short distance of one another. Some of those in the Midlothian basin have already been mentioned; to the west of the Pentland axis, Midcalder, West Calder, Livingston, Broxburn, Uphall and Pumpherston are the chief centres of population, and are entirely dependent upon the exploitation of the mineral resources for their prosperity.

The distribution of these mining centres accounts for the density of population in many of the parishes on the Midlothian coalfield and on the shale fields in the western part of the region. The remarkable increase in the total population of some of the parishes within the last half century has not been due to the development of a single centre, for Broxburn, with a population of less than 9000, is the largest town lying to the west of Edinburgh, but is to be accounted for by the rise of many small communities wherever mines have been opened up. Unfortunately the necessity for taking the parish as the unit in compiling the population map (Fig. 16), may give rise to an erroneous impression concerning the actual distribution of the inhabitants, which, however, may be corrected by a reference to the map showing the distribution of buildings throughout the district. In the parish of Currie, for example, a scantily peopled strip appears to extend far into the fertile plain; similarly in Midcalder: but this is due to the fact that in each parish there is a considerable tract of upland country which is practically devoid of population: the lower parts are as densely populated as in the adjacent parishes. The same explanation does not apply to the parishes of Abercorn and

Ecclesmachan, which present a marked contrast to the areas surrounding them. In the former case a very large area is occupied by a single estate, and there are no industrial centres within the parish; in the latter its purely agricultural character accounts for the sparse population, which in 1901 amounted to 681 inhabitants, or less than 170 persons per 1000 acres; within the last decade, however, the population has increased by 112 per cent. as a result of the mining developments within the area,

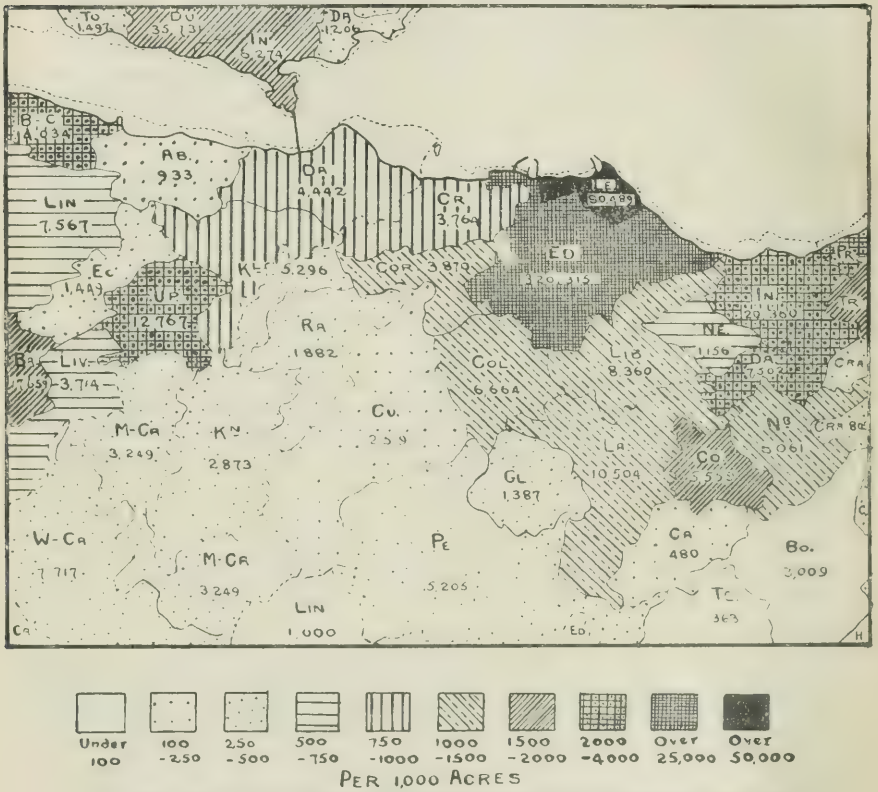


FIG. 16.—Map showing density of population and number of inhabitants in each parish, 1911.

which, nevertheless, still remains less densely populated than the surrounding parishes.

Finally there are the administrative centres, the seat of the county and government offices and of the legal and ecclesiastical courts. Originally owing its importance to its valuable strategic situation and its central position, various causes, some geographical, some historical, some produced by combined effort, others apparently quite accidental and arbitrary, have combined to give Edinburgh the chief position among the cities of the country.

The following table shows the percentage of the population of ten

years and upwards engaged in each class of occupation at the 1901 census :—

| Total engaged in occupations. | Profes-sional. | Domestic. | Com-mercial. | Agricul-ture and Fishing. | Industrial. | Unoccu-pied and Non-pro-ductive. |
|---|---|---|---|---|---|---|
| Midlothian— | | | | | | |
| Males, . . 82·6 | 7·4 | 1·7 | 18·6 | 3·1 | 51·9 | 17·4 |
| Females, . 35·3 | 2·6 | 14·2 | 2·2 | 0·7 | 15·6 | 64·7 |
| Linlithgow— | | | | | | |
| Males, . . 82·2 | 5·1 | 1·0 | 8·9 | 5·7 | 65·5 | 13·8 |
| Females, . 22·4 | 1·5 | 8·7 | 0·5 | 2·2 | 9·6 | 77·6 |

The most notable feature in this table is the different proportion of industrial workers in the two counties, there being a greater percentage of males engaged in industry in Linlithgow, but a much larger element of female industrial labour and also a much larger proportion engaged in domestic occupations in Midlothian. The fundamental cause of this difference is to be traced to the character of the population of the capital with its 400,000 inhabitants, and to the presence in Midlothian, and especially in Edinburgh, of certain industries such as printing, the manufacture of paper and of rubber goods, which offer a wide scope for female workers.

The fishing and agricultural industries being separately classified in the above table, the remaining industries may be divided into mining and manufactures, the latter being to a large extent determined by the former. The importance of the mining industry may appear from the following statistics of the output for 1909.

TOTAL OUTPUT OF MINERALS AND BUILDING MATERIAL FROM THE EDINBURGH DISTRICT DURING 1909.

| | Midlothian. | | Linlithgow. | |
|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. |
| | Tons. | £ | Tons. | £ |
| Coal, . . . . | 2,634,355 | 867,142 | 1,987,966 | 654,372 |
| Oil shale, . . . | 639,035 | 175,735 | 2,261,086 | 621,799 |
| Limestone, . . . | 162,862 | 30,854 | ... | ... |
| Igneous rocks, . . | 133,986 | 21,159 | 43,648 | 6,604 |
| Iron ore, . . . . | 37,772 | 12,433 | 18,063 | 5,946 |
| Clay, . . . . | 60,274 | 8,526 | 96,610 | 13,662 |
| Sandstone, . . . | 32,986 | 8,486 | 38,958 | 9,259 |
| Brine salt,* . . | 4,333 | 6,740 | ... | ... |
| Gravel and sand, . | 30,204 | 2,167 | 8,891 | 654 |
| TOTAL, . . | 3,735,809 | 1,133,242 | 4,455,222 | 1,312,296 |
| Total number of persons employed in mines and quarries, . . | 10,762 | | 9,732 | |

* Including the output of the works on the north side of the Forth that fall within the district.

Thus between the geological structure of the district and its economic development there is a very close connection.[1] The basaltic lavas and the intrusive dolerites, the glacial deposits and the underlying carboniferous sediments, all are utilised for local purposes, and they also play an important part in the wider commercial relations of the region.

The importance of the igneous rocks for the construction of roads has already been mentioned. The dolerite sill forming the Ferry Hills (Fig. 3) has been quarried for this and other purposes for over a century, and from it the greater part of the total output of igneous rocks from the county of Fife (amounting in 1909 to 167,000 tons) is obtained. About 100,000 tons are carried away every year from the quarries in the vicinity of Inverkeithing and North Queensferry, a considerable quantity being exported to the Tyne and Humber ports. But this large quantity will be much increased in the immediate future in order to supply the material required for the new base and dockyard port of Rosyth. The rock is also being used at present for the construction of the graving dock at Leith, and each week large quantities are sent across the Firth from the quarry in the Inner Bay at Inverkeithing. Boats can only enter the bay at high tide, when there is a depth of ten to fourteen feet of water. To overcome this difficulty and to avoid the loss of time which it would involve, a simple and rather ingenious device has been adopted. The broken or crushed material is carried in hutches from the quarry 150 yards away and emptied into a great box standing at the water's edge which is capable of holding a whole cargo at one time. The boat on entering the bay is berthed immediately beneath this box, the doors of which are then opened and the material pours into the hold without further attention (Fig. 17).

One of the first things to strike an observant visitor to the city of Edinburgh is the substantial appearance of its buildings, apart altogether from their architectural qualities, for the houses in even the poorest working-class districts present a marked contrast to the brick structures so common in most large cities, especially south of the Tweed. That the builders of Edinburgh have been able "to build for eternity" is entirely due to the fact that the physical history of the region has placed an abundant supply of good building stone within reach of the capital. And it probably also accounts for the large and important place which the building trade occupies among the industries of the district. Some of the most imposing of the Edinburgh buildings have been built of stone quarried at Craigleith, Binny, and Dalmeny; these stones are extremely hard and able to resist weathering to a remarkable degree, and many of the buildings for which they have been used show practically no signs of decay even after being exposed for a century to the ever-varying weather of the capital. The building of George Heriot's School, erected almost three centuries ago, shows fewer signs

[1] The recently published memoir of the Geological Survey of Scotland (*The Neighbourhood of Edinburgh*) contains several chapters dealing with the economic aspect of geology, which are as invaluable to the geographer as those on the physical structure of the region.

of weathering than does a recent addition to the institution built within the last few years but of much softer stone than the original building. The very qualities which render these stones so resistant have caused them to fall into disfavour in an age when so much stress is laid on cheapness, and now most of the stone required for building in Edinburgh is imported from other districts; being of much softer texture it can be worked more cheaply.

A second very important factor to the building trade of the district is the plentiful supply of lime which it possesses. The limework at Gilmerton is probably among the oldest in Scotland; the limestone at Burdiehouse has been worked for over a century and a half, although the operations were recently brought to a standstill owing to the

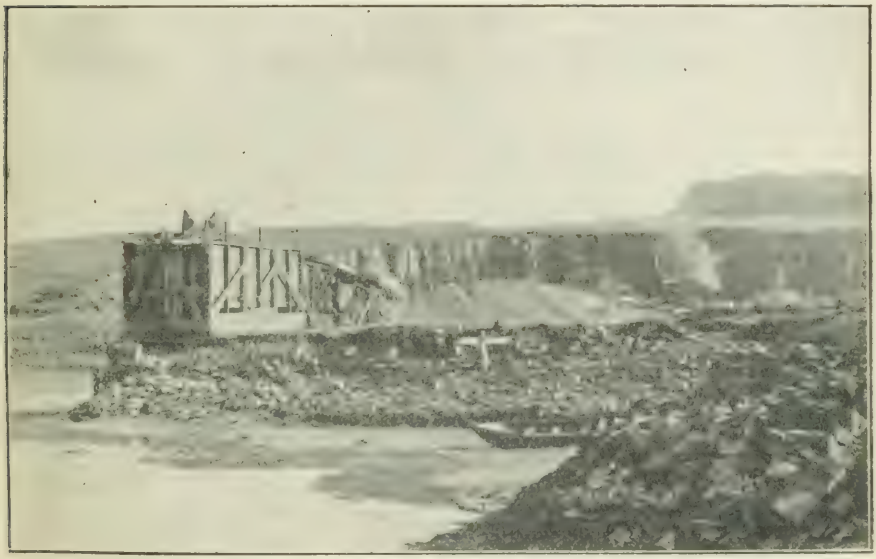

FIG. 17.—The Quarry at Inverkeithing.

presence of a fault which so dislocated the strata that it was not possible to trace the limestone, and considerable loss was incurred on this account, for the rubble that has taken the place of the limestone is of no economic value. The limestone has also been worked from time to time at various places on the Roman Camp ridge, especially in the neighbourhood of Cousland, where at present an attempt is being made to manufacture cement from a mixture of limestone and powdered shale. On the opposite side of the Forth the burning of limestone was formerly an important source of wealth—indeed, the industry has given its name to one of the villages; but neither at Limekilns nor Charlestown are the works in a very flourishing condition, and at the latter place the output does not exceed twenty-five tons per day, but the development of the port of Rosyth may open up a new market for the produce of the kilns.

Besides its use for building the limestone has been extensively employed for agricultural purposes, and much of the fertility of the region is no doubt due to the liberal supplies of lime so readily obtainable in every part of the district. Until recent years there was also a large demand for the lime for gas purification, and much of it found a market far outside the area. From the kilns at Esperston in the extreme south-east of the district, where the limestone is of an excellent quality, containing about 94 per cent. of carbonate of lime, considerable quantities have been sent by rail as far as Aberdeen; the nature of the export makes it impracticable to send it by sea, at least in ordinary boats. But the demand for lime for this purpose has decreased very much within the last decade, its place being now taken by oxide of iron. A considerable quantity of lime from the western part of the district finds its way to the smelting works of Lanarkshire.

Another circumstance which favours the building trade is the presence of valuable deposits of clay distributed throughout the region. Indeed, so valuable is this rock that at Prestongrange a thin seam of coal, in itself practically worthless, is worked for the express purpose of obtaining the underlying clay for making bricks. Brickworks are established at most of the collieries throughout the region, at Arniston, Newbattle, and at Whitehill, where an excellent brick is turned out and finds a wide market. Extensive works equipped with the most modern machinery are in operation at Camps and Winchburgh, whence considerable quantities are carried to the capital by the adjoining canal. One of the largest works in the district is established at Portobello, and here tiles, bricks, chimney and flower pots (of importance in view of what has been said about the number of nurseries within the district) and drain pipes are produced in large quantities. The bulk of the raw material is obtained on the spot, but a quantity of fire-clay is brought from the colliery at Newcraighall some miles distant. The finest clay has also proved suitable for the making of pottery ware. At Bridgeness a small pottery manufactures earthenware, but in this case most of the raw material is imported.

The glacial deposits of sand and gravel as well as the sand of the present beach have also contributed to the needs of the building trade, but none of the sand within the district has been found suitable for use in the glass works, and for this purpose a small quantity of very fine sand has to be imported.

But the most important deposits in the economic and social development of the district are the coal and oil shale measures. The rise of the shale industry in the middle of the nineteenth century accounts for the extraordinary increase in the population of Linlithgow between 1851 and 1861, for it is to this county and to the western part of Midlothian that the industry is almost entirely confined. In 1909 the output from the Midlothian mines amounted to 639,035 tons, and from Linlithgow to 2,261,086 tons, the combined output representing over 98 per cent. of the total for the United Kingdom. In the Midlothian basin several thin seams of shale were formerly worked at Straiton and Burdiehouse and provided employment for a considerable population. But the mining

operations were abandoned some years ago as a result of prolonged and expensive litigation occasioned by the complaint of the Edinburgh and District Water Trust that damage was being done to the overlying mains conducting the water-supply to the city. Within the last few months most of the houses formerly occupied by the employees in the mines have been pulled down. For some time operations have been carried on with a view to working the seams of oil shale that crop out near Eight Mile Burn, about six miles to the south-west of Straiton. If the project should prove successful a bleak moorland district will be transformed into a thriving industrial centre.

The vast mineral wealth contained in the shale measures has given rise to a large number of oil mills and refineries and chemical works. The average yield of oil from each ton of shale amounts to 23 gallons, although some of the most valuable seams may yield considerably over 50 gallons per ton; in addition to the lubricating and burning oils, the products of naphtha, paraffin wax, still coke, and sulphate of ammonia are of the utmost importance. As a result of the application of scientific methods to agriculture, and the increasing demand for artificial manures, increased attention is being given to the production of sulphate of ammonia, of which from 15 to 20 lbs. may be obtained from a ton of shale of average quality. Considerable developments in this connection are at present taking place at Pumpherston, Deans, and Seafield in the western part of the district. But the demand for liquid fuel for navigation purposes and the use of a bituminous binding material in the construction and relaying of the roads will certainly increase the importance of these products. The oils from the mills are sent to the home market in specially constructed tank waggons, and recently the Scottish oil refiners, adopting the methods of their American rivals, have introduced a type of oil tank cart in order to reach the smaller, and often remote, centres of population where there is still an extensive market for burning oils.

Both in tonnage and actual value the output of coal is of even greater importance than that of oil shale: in 1909 over two and a half million tons were extracted from the Midlothian fields, and about two million tons from the mines of Linlithgow. There is a large demand for coal for household and for industrial purposes within the district, but a large proportion of the output is exported, and the carriage of coal to the centres of population, especially to the capital and to the ports, forms a leading item in the goods traffic of the railways. Important developments are taking place in the Midlothian coalfield, especially in the neighbourhood of Wallyford and Prestonpans, and much of the recent increase in the population of Liberton parish is due to the extension of coal-mining within the area. The industrial development of the Forth basin, and the gradual exhaustion of the coal measures in the west of Scotland, will certainly increase the importance of the coal supplies within the Edinburgh district. A great expansion has been going on in the Bo'ness and Bathgate coalfields within the last few years, and has exerted a marked influence on the distribution of population within the region. One of the most interesting features of this development is the

attempt to work the undersea coal in the neighbourhood of Bridgeness,[1] and the experiment, in addition to its economic significance, is a useful illustration of how man may react upon his environment. To the east of Bridgeness a large tract of the flat muddy foreshore has been reclaimed within the last few years, and two pits have been sunk some distance below high-water mark in order to work the valuable seams that have been proved to extend across the Forth, and to crop out on the opposite side. Both pits are advantageously situated for the export of their produce by sea, each having its own piers and equipment for handling the coal. The refuse of the mines has been utilised in building the sea-wall and in filling up the reclaimed area; a quantity of material for this purpose is occasionally obtained from the boats that arrive in ballast to carry away cargoes of coal. On the other hand, the abundant supply of waste material from the mines makes it possible to supply ballast free of charge when it is required. This bold scheme of submarine coal-mining has been rendered possible by the geological formation of the channel. Above the sedimentary rocks in the bed of the river there lies a thick deposit of tough, unstratified boulder-clay, and this in turn is buried beneath thirty or forty feet of plastic clay of much finer texture: both deposits act as an impervious mantle for the valuable measures which underlie them. At Mr. Cadell's pit the shaft has been sunk to a depth of over 350 feet, but it has been found quite practicable to work even the highest seams of coal. As a result of the mining operations, and of the plasticity of the upper clay deposit, the subsidence of the floor has tended to increase the depth of the waterway, and thus to improve the conditions for navigation. Much of the reclaimed area, extending to several acres, is now occupied by the plant and sheds in connection with the pit, and also by a large timber-yard for which the supplies are brought by the boats entering Bridgeness for coal (Fig. 18). It is of some interest to note that there is a considerable element of female labour in this part of the district, not only at the pit-brows, but also in the timber-yards and saw-mills.

From the coal-mines of Midlothian a small quantity of ironstone is extracted: in 1909 the output amounted to 37,772 tons, and formed 0·3 per cent. of the total output of iron ore in the United Kingdom. There are, however, no furnaces in the immediate neighbourhood, and the ironstone is sent to be smelted at Shotts.

The geological formation of the district has exerted an important influence on the industries of the region quite apart from the working of the minerals. The water that collects in the calciferous sandstone in the vicinity of Edinburgh has been found to possess certain peculiar qualities which render it specially suitable for brewing purposes, and as a consequence there are over thirty breweries and distilleries in the neighbourhood of Edinburgh, which provide employment for a considerable proportion of the community. One street in the capital, about three-quarters of a mile in length, is almost entirely occupied by brewing

[1] "Submarine Coal-Mining at Bridgeness." H. M. Cadell. *Trans. Fed. Inst. Min. Engineers*. xiv. p. 237.

establishments, and the recent development of the village of Duddingston, on the east side of Arthur's Seat, is entirely due to the erection of several large breweries and distilleries in the vicinity.

The quality of the water also may partly account for the rise of several bleachfields and dye-works near the capital, especially at Slateford, Gorgie, and Corstorphine, the last being established at a very early date in connection with the linen industry that once flourished in the district. Of still greater importance are the paper-mills that have been established along the banks of the Water of Leith and the Esk, and also at Inverkeithing. So entirely dependent are some of the communities in those localities upon the paper-making industry that when one of the

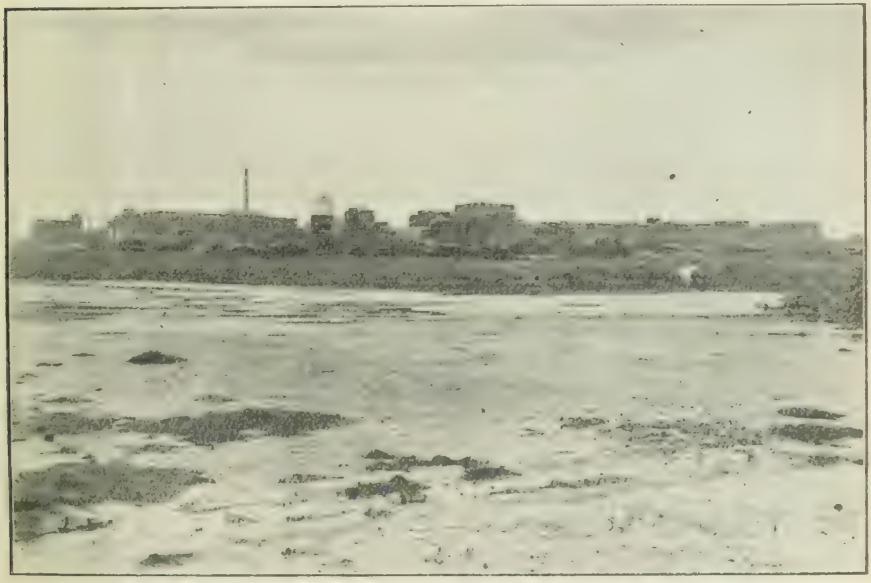

Fig. 18.—Pit and timber-yard on reclaimed foreshore, Bridgeness.

mills on the Water of Leith was recently destroyed by fire practically the whole working population of the village was thrown out of employment. The making of paper throughout the district and the manufacture of printing ink at Granton are closely allied to the printing trade of Edinburgh, which affords employment for about 5000 persons, including a large proportion of female workers. The location and development of this trade in Edinburgh, until it may almost be regarded as the staple industry, is intimately related to the historical development of the city, and the result of several causes which are not primarily geographical: the establishment of the printing presses of Chapman and Miller; the rise of the University; the presence of the Law Courts, and the consequent demand for printed matter; the ecclesiastical and political struggles which found expression in innumerable pamphlets; the rise of many educational institutions with their extensive demand for school-

books; but perhaps of the greatest importance, the activities of the distinguished literary circle towards the end of the eighteenth and opening of last century, which gave Edinburgh so high a rank in the intellectual world, and especially of the Wizard of the North whose own connection with the trade proved so disastrous.

To individual genius and industry also, rather than to any natural advantages of position, except perhaps the presence of a supply of skilled labour that could be adapted to the special needs of the situation, must be ascribed the importance of Edinburgh for the publication of cartographical works, of which the monumental *Atlas of Meteorology* and the more recent *Atlas of Zoology* are the finest examples.

Within recent years the prosperity of the Edinburgh printing trade has shown a slight, and perhaps temporary, decline. Contributing to this has been the rise of several large firms within easy reach of the publishing centre in London, at Southampton, Frome, and Letchworth. Moreover, the change in the labour conditions in the Edinburgh printing trade is of the utmost significance. If, on the one hand, the element of female labour should be eliminated from several of the departments in which it has formerly played an important part: or if, on the other hand, the demand for equal wages for male and female workers should be enforced, the Edinburgh firms would find it difficult to compete as successfully as formerly with the English presses.

It appears, however, that the paper-making industry of the district has been quite unaffected by any decline in the Edinburgh printing trade; it is from the publishers in London that the orders for paper are obtained, and if less is now sent to Edinburgh, more is required to be sent to the English printing-houses.

Both the fishing and agriculture of the district have given rise to a number of very important subsidiary industries and occupations. Dependent upon the former are the sail-cloth factories at Leith and Musselburgh, and the large net-works at the latter place. Of even greater importance are the cooperages which supply not only the needs of the fish merchants, but also of the breweries and distilleries. One of the largest firms in the country for the sale of hoops is established in Edinburgh, and supplies not only the demands of the local trade, but also of the fishing centres as far north as Wick: but a large proportion of the material is now imported from the Continent.

It was from the royal dockyard at Newhaven that "ane varie monstrous great schip called the *Michael*" was launched in 1511; Leith is now the chief shipbuilding centre in the district, but there are important yards at Granton, while at Bridgeness a ship-breaking yard affords employment for a considerable number of men.

Originally dependent upon the agricultural resources of the region are the large number of flour and meal mills that are distributed along the river courses of the district, at Polton, Lasswade, Colinton, and Midcalder. But the milling industry is now chiefly centred in the large establishments equipped with the most modern machinery that have been erected in Edinburgh and Leith within easy reach of the home produce, and also of the supplies imported at the seaboard.

It is to the advantage of the several tan-works in Edinburgh that a very large number of cattle are reared within the district, and the manufacture of boots and shoes of the best quality is providing employment for an increasing number of people.

An important development in connection with the extensive building trade to which the growing population of the capital and the surrounding districts has given rise is the manufacture of steel girders and roofs. Again, as a result of the demands of the paper-making industry, the manufacture of machinery for this purpose has become an important branch of the local engineering industry, with its 8000 workers.

Edinburgh has been a leading centre for the carriage-building industry since the close of the eighteenth century, when, according to Creech,[1] an Edinburgh coachbuilder received an order from Paris, which was then generally regarded as the chief seat of the industry, "for one thousand crane-necked carriages to be delivered within three years." Within recent years the demand for horse-drawn vehicles has greatly declined, but partly because there already existed a large supply of highly skilled labour, and partly because Edinburgh offers a good market both for pleasure and for commercial vehicles, the building of bodies and the assembling of motor-cars is steadily becoming one of the important industries, and already considerable capital has been expended in the development of large motor-works at Gorgie, Granton, and elsewhere throughout the city.

But of course it is not always possible to offer a geographical reason for the foundation of particular industries in certain places. This is certainly true in the case of one of the most important industries in Edinburgh—the making of rubber goods. The industry was introduced from America about the middle of last century, and a number of skilled workers were brought over to instruct the natives employed in the works. But it is not clear that, at that time at least, Edinburgh enjoyed any superior advantage for the development of the industry. It may be that the large population of the city, with a considerable element engaged in duties that entail much going and coming between various parts of the town and consequent exposure to its varying weather, may have seemed to offer a market for the produce of the rubber works, and it happened that a large building, that had been erected as a silk factory but was ultimately abandoned, was available at the time. But when the industry had been established, there is no doubt that its development was assisted by the abundant supplies of naphtha obtainable from the neighbouring oil shale fields. To-day Edinburgh has become one of the leading centres in the world for the manufacture of rubber goods, in which over two thousand persons, including a very large proportion of female workers, find employment.

But although Edinburgh possesses many advantages for industrial purposes in its abundant supply of cheap fuel, its available land and excellent building materials, its stores of water, its plentiful supply of

[1] *Letters on the Mode of Living, Trade and Literature, etc., of Edinburgh in 1793 and the present period.* Edinburgh, 1792.

labour, both skilled and unskilled, its opportunities for technical training, and in its extensive world connections, both by land and sea, affording easy access to the source of raw materials for manufacture and to the best markets for the manufactured articles, yet these advantages have never been fully utilised, and Edinburgh has failed to take the place in the industrial world to which its situation would seem to entitle it. At the present time there are 129 factories within the burgh of Edinburgh, and according to the 1901 census 51 per cent. of the male population in the city were engaged in industrial pursuits; nevertheless the dominant social type is not industrial but professional and commercial: 9 per cent. of the male workers and 3 per cent. of the female workers were engaged in professional occupations; 18 per cent. of the males and 2 per cent. of the females were employed in some form of commerce. In the burgh of Leith the commercial element forms almost 30 per cent. of the male population. The character of the city is the expression of its past history, and this has to a large extent been moulded by geographic influences. Under these and other forces Edinburgh eventually became the metropolis of the country, the seat of the Courts of Justice, of the Government offices, of a University, and many tributary educational institutions, and the ecclesiastical capital. Hence Edinburgh is essentially a residential city, the home of a large official element, attracting a considerable population by reason of its educational advantages and unique opportunities for certain branches of study, and inviting a large temporary population at certain seasons of the year by reason of its historical and literary associations as well as by its picturesque and healthy situation.

Although Edinburgh is no longer the commercial capital it still exerts an important influence upon the business and industrial interests of the country. When it became the headquarters of the banking business it occupied the leading place in the national commerce and industry; and although it has long been surpassed by Glasgow it still remains the financial metropolis and is the seat of the chief banks and insurance offices.

The social character and economic status of the community are reflected in the type of house which predominates in Edinburgh. There are 68,620 dwelling-houses in the capital, and their annual rental is distributed in the following proportion:—

| Annual Rent. | Per cent. of Total Number of Houses. |
|---|---|
| Under £10 | 33·2 |
| £10—£20 | 36·8 |
| £20—£50 | 21·9 |
| £50—£150 | 5·7 |
| over £150 | 2·4 |

Thus there is a very considerable well-to-do class which, in addition to creating a certain social atmosphere, is the means of affecting the distribution of occupations by giving employment to a large number of servants. In 1901 there were over 22,000 females in Edinburgh engaged in domestic offices or services.

Then Edinburgh as a university town, a tourist centre and holiday resort, contains a large number of people who obtain a livelihood by providing accommodation for visitors to the city. To meet the material needs of food and dress of the large population there is a large army of shopkeepers and warehousemen; and the presence of a wealthy element in the community and the popularity of Edinburgh as a tourist centre account for the large number of jewellers' and fancy goods shops in the capital. Finally, there is a very large section of the population engaged in the transport services—as railwaymen, carters, tramwaymen, porters, messengers; over 13,000 persons were thus occupied in Edinburgh at the date of the 1901 census.

## Trade and World Relations.

The main factors in the trade and commerce of the district are its natural resources and the character of its industries on the one hand, and its world relations on the other.

A study of the topographical map will show that an extensive system of roads and railways brings the district into direct relation with all the leading centres of population throughout the kingdom. Of equal importance is its position on the seaboard. The relation of the leading port in the district to other ports in the country and to the Continent is seen from the following table of steaming distances from Leith:—

| *To* | | *To* | |
|---|---|---|---|
| Aberdeen, | 85 Miles. | Christiania, | 550 Miles. |
| Newcastle, | 115 „ | Copenhagen, | 616 „ |
| Hull, | 235 „ | Dantzic, | 890 „ |
| Southampton, | 506 „ | Riga, | 1083 „ |
| Glasgow (by Channel), | 1063 „ | Cronstadt, | 1284 „ |
| Rotterdam Canal, | 353 „ | Gibraltar, | 1745 „ |
| Antwerp, | 445 „ | Naples, | 2670 „ |

In addition to the harbour and wet docks at Leith, covering almost one hundred acres, there are seven dry docks, while an eighth is in course of construction. The port is closely connected by rail, not only with the adjacent mineral fields of the Lothians, but also with the manufacturing towns in the Tweed valley, with the Lanarkshire coalfield, and the industrial centres of the Midland Valley. The docks are fully equipped with the most modern mechanical appliances for handling goods, including powerful hydraulic cranes and coal hoists, grain elevators, and extensive sheds and yards. The depth of water at high-tide varies in different docks from eighteen to thirty-one feet, allowing for ships of considerable tonnage; pilotage is non-compulsory. But of course the huge vessels carrying on a trans-oceanic trade from the Atlantic ports are unknown in a port situated on the North Sea which can be crossed in a few hours.

At Granton there is an "open harbour," fully equipped with sheds and modern machinery for the rapid handling of the goods. The fact that this harbour is private property, while that at Leith is controlled by a public body, accounts for a difference in the harbour dues of the two ports which has a considerable effect upon the trade.

There are also small harbours with a local trade, usually in connection

with adjoining collieries, at Prestonpans, Bridgeness, Charlestown, Inverkeithing, and St. David's; also a small fishing harbour at Fisherrow, and piers at Queensferry, Port Edgar, and Aberdour.

From Leith and Granton a regular coasting trade is carried on and the Forth ports are in direct communication with those of the Bristol Channel and the Mersey. A regular service is also maintained with leading ports on the North Sea and the Baltic, while boats run to Calais and Dunkirk as the trade requires.

In 1910 the value of the imports at Leith and Granton amounted to fourteen and a quarter million pounds, and the combined exports to seven and a quarter million pounds. The most important item on the list of imports is the large quantity of foodstuffs required for the densely populated hinterland. First in importance is grain, consisting chiefly of wheat, on which the milling industry depends, and of barley and maize which are required for the breweries and distilleries of the district. Butter, eggs, cheese, and bacon come next in importance on the list of imports: a considerable quantity of the dairy produce is consumed within the district, a large proportion of the eggs, for example, being used in the baking establishments of the capital: but much of the produce is sent throughout the country by rail from Leith. Large quantities of refined sugar are imported from Germany, and also a small quantity of raw sugar for the local refineries. A considerable quantity of fruits (apples, pears, and plums), and such vegetables as cabbages, carrots, and onions, form important items among the foodstuffs. Among the imports of raw materials or partly manufactured articles the chief are linen yarn, woollen and worsted yarn, flax, and hemp: but, perhaps, the most interesting is the import of paper-making materials for the mills of Midlothian. These include esparto from Algeria and Spain, rags and rag waste from France, Belgium, and Holland, and wood-pulp from Scandinavia. But the remarkable point is that Granton receives by far the greater proportion of this import, although it is not more favourably situated with reference to the mills than Leith is. In 1910 the imports of paper-making materials at Leith amounted to £100,721; at Granton they amounted to £304,907. It appears that this great difference is simply the result of the lower dues chargeable at the latter port. Another instance of a considerable volume of trade being turned into another channel from a similar trifling circumstance may be quoted, although it does not properly come within the area. Prior to 1908 iron ore of the average value of £10,000 was imported annually at Bo'ness: but in that year the dockers demanded an increase of a penny per ton for unloading the ore, with the result that the trade was diverted to Grangemouth and no iron ore has entered Bo'ness since that date. Timber occupies an important place in the trade of the district; a considerable quantity is required for the building trade, but still more significant is the demand for pit props for the rapidly developing mineral fields. The bulk of this material is obtained from Scandinavia and the Baltic ports.

A large quantity of woollen yarn and linen yarn enters at Leith, and is forwarded by rail or transhipped to the manufacturing centres.

Reference may be made to several articles of import which, although not necessarily occupying a high place upon the list of values, are of importance to the industries of the district: caoutchouc, hemp, china clay, chiefly from the deposits of Cornwall and Devon, for use in the potteries and paper-works; tobacco, the manufacture of which is of considerable importance in Edinburgh; cattle-feeding stuffs, hay and moss litter, for which there is a large demand in the stables of the neighbourhood; dairy appliances from Denmark and Holland, and bottles for use in the breweries and chemical works of the district.

Perhaps the most notable feature of the export trade of the district is the phenomenal increase in the output of sulphate of ammonia.

| | | | |
|---|---|---|---|
| The export in | 1904 | amounted to | £378,964 |
| ,, | 1906 | ,, | £423,441 |
| ,, | 1908 | ,, | £546,298 |
| ,, | 1910 | ,, | £681,883 |

If to this value in 1910 is added that of the paraffin wax and oil exported, the products of the oil-shale fields become the leading item in the export trade. A considerable quantity of paraffin wax is sent to Sweden where it is used in the making of matches, of which large quantities enter this country every year.

Machinery, however, forms the most valuable single item in the foreign trade, the export from Leith in 1910 amounting to £878,663. Next in order comes the export of coal. In addition to the coastwise trade, 1,335,403 tons were sent out from Leith and Granton in 1909 of this quantity 32 per cent. went to Germany, and the bulk of the remainder was distributed to the Netherlands, Sweden, Russia, Brazil, and Denmark; while a small cargo also found its way to Bombay, Canada, and the Falkland Islands. Thus the boats from the Baltic and North Sea ports have little difficulty in obtaining a "back" cargo. From the evidence given before the Royal Commission on Coal Supplies, it appears that the average freight over the period 1893-1902 from the Forth to Cronstadt was about 5s. per ton, but the cost of carriage from the Lothian collieries to the dock is 1s. 2d. per ton, and this heavy charge is regarded by the coalmasters as a serious hardship in their competition with the German exporters. Moreover the inadequate service provided by the railway companies, as well as the high rates, has led the colliery owners and coalmasters to undertake the construction of a mineral railway between the various mining centres in Midlothian and East Lothian and Leith, whose importance as a coaling station and exporting centre will certainly increase with the development of the Forth basin.

In the case of the collieries at Bridgeness there is no necessity for land carriage, and in this respect these pits have a decided advantage over the Lothian collieries even within a very few miles of the seaboard. The chief market for the submarine coal has for some time been the State Railways and the dairies and mills of Denmark. The demand for this coal, however, is extending, and increasing shipments to Holland and Germany are reported. A considerable coastwise trade is

done, especially to the North of Scotland, where it is used as bunker coal on the Moray Firth trawlers.

In concluding this attempt to consider the more important phenomena of the Edinburgh district from a geographical point of view, I wish to acknowledge my obligations to the various authorities and individuals from whom I have so readily received assistance in the preparation of the paper. It was originally prepared in connection with the work of the Oxford School of Geography, and I am indebted to Professor Herbertson for many valuable suggestions. To Dr. Bartholomew for granting me the use of the topographical map which accompanies the paper and for the work he has bestowed upon my own tracings, I have to express my cordial thanks.

## Table of Areas.*

| | Sq. miles. | |
|---|---|---|
| Land on the north side of Forth at low water, total, . . | 18·01 | ... |
| Do. from 0-250 feet, . . . | 18·01 | 100 |
| River and Firth of Forth at low water, total, . . . . | 88·77 | ... |
| Do. from 0-5 fathoms, . . | 46·73 | 52·65 |
| „ „ 5-10 fathoms, . . | 29·22 | 32·91 |
| „ over 10 fathoms, . . | 12·82 | 14·44 |
| Islands of the Forth, . . . | 0·37 | ... |
| Land on the south side of Forth at low water, total, . . | 326·11 | ... |
| Do. from 0- 250 feet, . . | 90·38 | 27·71 |
| „ „ 250- 500 feet, . . | 80·72 | 24·75 |
| „ „ 500- 750 feet, . . | 67·41 | 20·67 |
| „ „ 750-1000 feet, . . | 57·02 | 17·48 |
| „ „ 1000-1250 feet, . . | 12·81 | 3·93 |
| „ „ 1250-1500 feet, . . | 13·68 | 4·19 |
| „ „ 1500-1750 feet, . . | 3·59 | 1·10 |
| „ over 1750 feet, . . . | 0·56 | 0·15 |

* The measurements were made on the accompanying topographical map, which covers a slightly larger area than the Ordnance Survey one-inch map, to which the measurements in the text refer.

# A GEOGRAPHICAL FACTOR IN SCOTTISH INDEPENDENCE.

By W. R. Kermack.

The outstanding fact in the history of Anglo-Scottish relations from the fourteenth to the sixteenth centuries, as, in a less degree, in the seventeenth century also, is the failure of the richer and more powerful country in its attempts to absorb its smaller northern neighbour; and this failure, though due also to many other influences, was in part the result of geographical factors which favoured the preservation of Scottish independence. The most striking geographical difference, for example, between the campaigns of Edward I. in Wales and in Scotland is the difference in the distance from his base at which he had to operate. The wealth and population of mediæval England were concentrated in the south and eastern counties, those nearest to the continent, and Snowdon, the last stronghold of Welsh nationality, lay, even as the crow flies, only about half as far from London as the centre of Scottish resistance, whether Perth, Stirling, or Edinburgh. Even in the sixteenth century despatches still took forty-eight hours to reach Newcastle from London, and, in the fourteenth, Edward found it quite impossible to conduct the campaigns in which, for six years from 1298, he strove to complete the conquest of Scotland, while the administration of his kingdom was centred in the south. The courts of justice and the machinery of government were accordingly transferred to York, and it is likely, if Scotland had been held, that the old military capital of Roman Britain would have become the permanent centre of the government of these islands.

But the problem of distance was not the only one to be solved by an invader. A remarkable similarity exists between the lines of operation chosen by the English commanders in all the most serious attempts against Scotland. Edward I. in 1296 and 1298, Somerset before Pinkie (1547), Cromwell in 1650, all, passing the Tweed at Berwick or Coldstream, reached the Lothians by way of Dunbar. Edward in 1296 was opposed by the Scots at Dunbar; on the same ground in 1650 Leslie threatened Cromwell's retreat; while Somerset, though his advance was in fact unopposed, expected to meet with resistance south of Dunbar at Cockburnspath. And the adoption of this line of advance may also be paralleled in the campaigns of John of Gaunt or Edward III. It was the geographical problem presented by the Scottish frontier which compelled so strange a similarity in choice.

For some five and thirty miles the boundary between England and Scotland is formed by the grassy, glen-scored Cheviots, over which the main pass is that at Carter Bar (1405 ft.), where the road up Redesdale, from Newcastle and Hexham by Otterburn, crosses to Jedburgh. Further to the east the Roman road from the Wall near Corbridge, known in mediæval charters as Dere Street, but misnamed Watling Street by modern antiquaries, crosses the Cheviots at Streethouse, rounds the edge of Shibden Hill, and continues in straight course

past the fort at Cappuck and the field of Ancrum Moor to the recently excavated Roman station at Newstead, near Melrose. West of the Cheviots the frontier is continued by the Liddel and Esk; the lower course of these rivers in the Middle Ages traversed the bog of Solway Moss; to the east, from a point just east of Carham, the frontier is formed by the Tweed. The Tweed from a very early period was bridged at Berwick and at Peebles, but, until times comparatively recent, at no point between. Even at Berwick there was no bridge between 1294 and 1376; and the bridge of fifteen arches which is still in existence was built only in 1624. The fords of the river were consequently of much importance, and of these the chief was near Coldstream, at the confluence of the Leet and the Tweed. It was used, among other occasions, in 1296 by Edward I., by the Scots army before and after Flodden, by the Covenanters in 1640, and twenty years later by General Monk. Another ford was at Norham, about ten miles above Berwick; it was crossed in 1296 by the Bishop of Durham's division of the English army, and in 1648 by Cromwell. Above Coldstream, the towns of Birgham, Kelso, and Melrose all sprang up at fords on the Tweed.

This line of frontier was in the main a natural one, and, from the English point of view, secured to them the means of communication between east and west which is afforded by the Tyne Gap, the valley of the South Tyne river, which separates the Cheviots from the Pennine Chain. This same object, on the other hand, had also been secured by the frontier of the Roman province of Britain, the great Wall of Hadrian and Severus, which ran from Tyne to Solway across the moors immediately to the north of the Gap: the building of Newcastle by the Conqueror in 1080 suggested a disposition to retain this line as the military frontier of England; the recovery of Carlisle was left to Rufus; and it was only the foundation of Norham Castle by Henry I. in 1121, and his fortification of Carlisle the year following, that made clear a determination to hold effectively the geographical frontier of the kingdom. From this time onward it became the general English policy to check Scottish inroads by the defence of the frontier fortresses, Wark and Norham on the east Border, Carlisle on the west, the fortified town of Hexham in the centre, and thus to gain time for the concentration, generally at Newcastle, of the forces of the northern shires. It was Newcastle, too, which commonly served as base for an invasion of Scotland, though naturally any attack across the western Border was made from Carlisle. On the east, besides the road over the Cheviots by Carter Bar already mentioned, the lines of advance for an invading army followed either the Till valley or the coastal belt east of the Till. Just north of Hadrian's Wall a branch road, known as the Devil's Causeway, left the Roman road from Corbridge to Newstead, and ran north-east by the field of Hedgeley Moor to the mouth of the Tweed. This road was used in 1462 by Warwick for the connection of his outlying forces engaged in the siege of Alnwick, Dunstanborough, and Bamborough. From Kelso a second road ran south-east by Mindrummill and the Glen valley to Wooler, where it was joined by a branch from

Coldstream by Milfield, a name which perpetually recurs in the history of Border warfare. Its course southward from Wooler lay somewhat to the west of the present line of railway, by Ilderton and Brandon to Rowburn, where it joined the Devil's Causeway. Lastly, the main coastal route ran from Newcastle by Morpeth, Felton, Alnwick and Belford to Berwick, which last place, it must be remembered, was after 1482 an English bridge-head, strongly garrisoned. After much rain, however, all these roads were liable to become impassable for heavy transport, and almost so for infantry.

Beyond Tweed, on the Scottish side, lay the districts of the Merse and Tweeddale, rich, and almost inviting the invader; and beyond these again what was the real military frontier of Scotland on the east, the Moorfoot and Lammermuir Hills which, broken only by the valley of the Gala, stretch from above the Tweed at Peebles and Innerleithen almost to the North Sea between St. Abb's Head and Dunbar. A Roman road was carried from Newstead up the valley of the Leader, past Soutra Hill, to the Forth at Inveresk and Cramond; and this route by Lauder seems also to have been that chiefly in use in the Middle Ages, in preference to the Gala valley now followed by the line of railway between Edinburgh and Melrose. The map of Lothian in Blaeu's Atlas of 1662, however, shows that another road ran south from Edinburgh, crossing the North Esk by a bridge at Lasswade, and, passing east of Arniston and Temple, traversed the Moorfoots apparently to the Tweed valley near Innerleithen. Yet another route by Gifford and Longformacus, over the Lammermuirs, was used in 1715 by the Highlanders under Mackintosh of Borlum. But none of these lines offered in any way an easy advance to an invader, and all were far surpassed in importance by the coast road from Berwick, which traversed the narrow belt of low-lying ground between the Lammermuirs and the sea, thus turning the east flank of the defensive mountain line, and giving access from the Merse to the fertile Lothians. This was the line of advance followed by Edward I., Somerset, and Cromwell, and its importance was greatly increased by the obstacles offered to invasion on the western Scottish frontier. On this flank conditions, within limits, were very similar to those already described on the east. Here, too, the districts nearest England, Annandale, Nithsdale, and Galloway, were on the whole, low-lying and open to the invader. Here, too, beyond them a formidable barrier to military operations was opposed by the mountain mass of the Southern Uplands. The route up Annandale, followed to-day by the Caledonian Railway, over a summit 1000 feet above sea-level, was only preferable to the wild passes—Enterkin and Dalveen—which gave access from Nithsdale to the valley of the Clyde; while the route up Nithsdale taken by the modern Glasgow and South-Western Railway, if presenting fewer natural difficulties, only reached Glasgow by way of Ayrshire. So far, then, the resemblance between west and east held good. But in the west no parallel existed to the coast road of the east, and hence it was that every attempt at conquest or at the infliction of serious damage was directed against the eastern rather than against the western frontier. From the point of view of

the defensive, however, it may be noted that the valleys of the Teviot and Rule Water on the east, and on the west of the Liddel, Ewes, and Esk, gave fair lateral communication between the Merse and Annandale behind the screen of the Cheviots. A good example of the use to be made of this means of communication, especially in conjunction with the southward extension of the Cheviots in the Pennine range, may be studied in the movements of Prince Charles's army in the 1745 campaign.

The Scottish frontier was thus on the whole, though weak against raids, strong against an attempted conquest of the country. On the outbreak of the Wars of Independence such attempts were met by a vigorous defensive. Balliol fought in 1296 at Dunbar; Wallace fought, though further to the west, at Falkirk. In both cases the result was a crushing defeat, and though Bruce gave battle successfully at Bannockburn, it was against his consistent policy that he staked his kingdom upon a single throw. Henceforward, therefore, the Scots adopted the methods of passive defence recommended in "King Robert's Testament." Warned of the coming enemy by the beacons fired by watchers at the fords of the Tweed, which were repeated at Hume Castle, Edgarhope Law, Soutra Hill, North Berwick Law, and Traprain, they made no attempt to meet the invader in the field, but, driving off their cattle and burning their crops, they left the countryside barren and desolate before his advance, while at the same time a raiding force probably burst across the west frontier to destroy "in the bishoprics of Durham and Carlisle more than the value of all the towns in the kingdom of Scotland" (Froissart). Such a policy at once brought the English invader face to face with serious difficulties in the matter of supplies, and the problem would have been insoluble had not the English naval supremacy, uncontested save for a few years in the reign of James IV., made it possible for a fleet, carrying provisions, to accompany at sea the advance of the land forces by the coastal route. Upon the successful execution of this policy, which may be paralleled from Edward I.'s Welsh campaigns, depended very largely the prospects of the expedition. In 1298, for example, the non-arrival of the fleet had brought Edward to the decision to fall back on Berwick before he learned that Wallace was awaiting him at Falkirk. Nor did the condition of the harbours on this coast, thus rendered of strategical importance, greatly favour the invader. Cromwell declared in 1650 that all the coasts from Berwick to Leith did not contain one good harbour. Berwick itself appeared in 1636 to Sir William Brereton "a most narrow, shallow, barred haven, the worst that I have seen"; while Dunbar was "so environed with shelfs, bars, and sands as there is no manner of haven; only here is a haven made of great stones piled up, whereinto at a spring-tide a ship of one hundred ton may enter, but not without much hazard." Neither at Dunbar nor at Musselburgh could supplies be landed from the fleet save under favourable weather conditions.

However great the difficulties, on the other hand, such Fabian strategy might impose upon the invader, the price paid for success in the abandonment of Scotland's richest town and most fertile provinces to

the national foe was a heavy one, and one that the self-respect of a more centralised country could not afford to pay. It was not possible for France in 1870 to adopt the policy of the Russians in 1812 or the Boers in 1900. With the increase in material prosperity, therefore, that marked the reigns of the later Jameses, and especially with the recognition of Edinburgh as the capital, came a return to a more active defensive policy. The coast road from Berwick, from Ayton nearly to Dunbar, traversed a stretch of desolate moorland, and at Cockburnspath entered a defile so narrow that there, in Cromwell's phrase, "ten men to hinder are better than forty to make their way." Neither at this point nor at Dunbar, however, nor yet where the Edinburgh road crossed the Tyne at Linton Bridge (East Linton), did the Scots choose to make a stand. The defence of any of these positions would have relieved the invader of half his difficulty as to supplies, while all were liable to be turned by an advance by Lauder over the Lammermuirs, or by a movement by sea such as Hereford's raid in 1544. Exceptional conditions in 1639 which gave to Scotland an unwonted military superiority enabled Alexander Leslie to concentrate south of the Lammermuirs at Duns, where he was so placed that "if the English had moved either towards Haddington or Soutray, he might have been on their backs" (Baillie); the position was reoccupied the following year: and it was understood that, had time permitted, in 1650 also the same course would have been followed. But normal conditions compelled a less ambitious policy and the occupation of a position near the capital. At Musselburgh the main road from Dunbar by Haddington and Tranent, and the coast road by Preston from North Berwick united to cross the Esk by the ancient bridge, while through or near Dalkeith the hill roads from Lauder, the Gala valley, and Innerleithen approached Edinburgh. A force holding the west bank of the Esk thus commanded every line of advance, and it was at Musselburgh that the Scots took post before Pinkie, as Prince Charles Edward proposed to do before Prestonpans. David Leslie's position in 1650, "between Edinburgh and Leith, entrenched by a line flankered from Edinburgh and Leith," retained the advantages of the Esk position, save the actual obstacle the river afforded: while under somewhat altered circumstances the defensive occupation of the river line was recommended in 1803 by Dumouriez, as allowing reinforcement by the hill roads from England in case of a French landing and an advance upon Edinburgh from the east.

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## A NEW GRAPHIC MAP.

By J. P. Strachan.

*(With Maps.)*

The Parabolic projection of the globe has fully 9 million square miles too many in the map: the Elliptic is 45,733,800 in excess: the Orthographic (Hemisphere) totals 49,341,200 instead of 98,682,400:

and the Quadrant used as a radius contains some 46½ million square miles too many. It thus follows that in none of these is the map equal in area to the surface of the globe.

The sinusoidal curve has been already used for continents, but Mr. Alexander Clark, A.M.Inst.C.E., of Edinburgh, has brought to perfection a system—it is not really a projection—based on the sinusoidal principle, by which we have:—(1) equal-areas all over the sphere, (2) the possibility of accurate measurement between any two points, and (3) the finding of a ship's course.

For the sake of illustration we reproduce here, by the kind permission of Mr. Clark, a map of the sphere (Fig. 1), as also a chart of the North Sea (at end).

The form of the map of the globe is so different from that to which we are accustomed that it is difficult to understand at first that it represents the exact area of the sphere. The main objection to the use of it seems to have been that by this method the portions of the globe which are furthest removed from the major and minor axes are shown in rather high perspective when the whole sphere is in view, but these objectors forget, when they put forward this criticism, that they are generally comparing the complete sphere with the proportions of the hemisphere, to which their eyes are usually accustomed. Now, it is well known that, in any perspective, the parts which are more remote from the line of sight are more altered in figure than those parts which are quite near or within a medium range of angle; hence it is very evident that when a map is drawn of the whole sphere, the change of form is considerably more than double that of the change in a hemisphere. To meet this criticism there is no difficulty in producing a map from different centre lines, so that the parts near the central lines will come in their turn into the best position for square representation. The maps which are so delineated in this series have their centre lines (1) through 0°, the Greenwich Meridian (the British Map); (2) through 90° East, near Calcutta (the Indian Map); (3) through 90° West (the American Map; and (4) through 180° East or West (the New Zealand or Siberian Map).

Besides these forms of the whole sphere, two combinations of hemispheres can be made, and are produced from these maps, namely:—(a) By combining the central 180° of No. 1 with the central 180° of No. 4, and (b) similarly combining the central portions of Nos. 2 and 3.

In the first method, with the four-sphere maps, the change of form only affects 45° on each side of the centre line on each map, so that the whole world is brought within this limit of perspective. It must also be remembered that over the whole globe, in all these maps, equal areas are maintained, and distances between any two places on the surface of the globe can be accurately measured.

If any of the ordinary maps or projections now in use be examined, it will be found that none of them are true drawings, but merely approximations made up of averages over comparatively narrow spaces, with continually changing scales, so that no particular space or distance

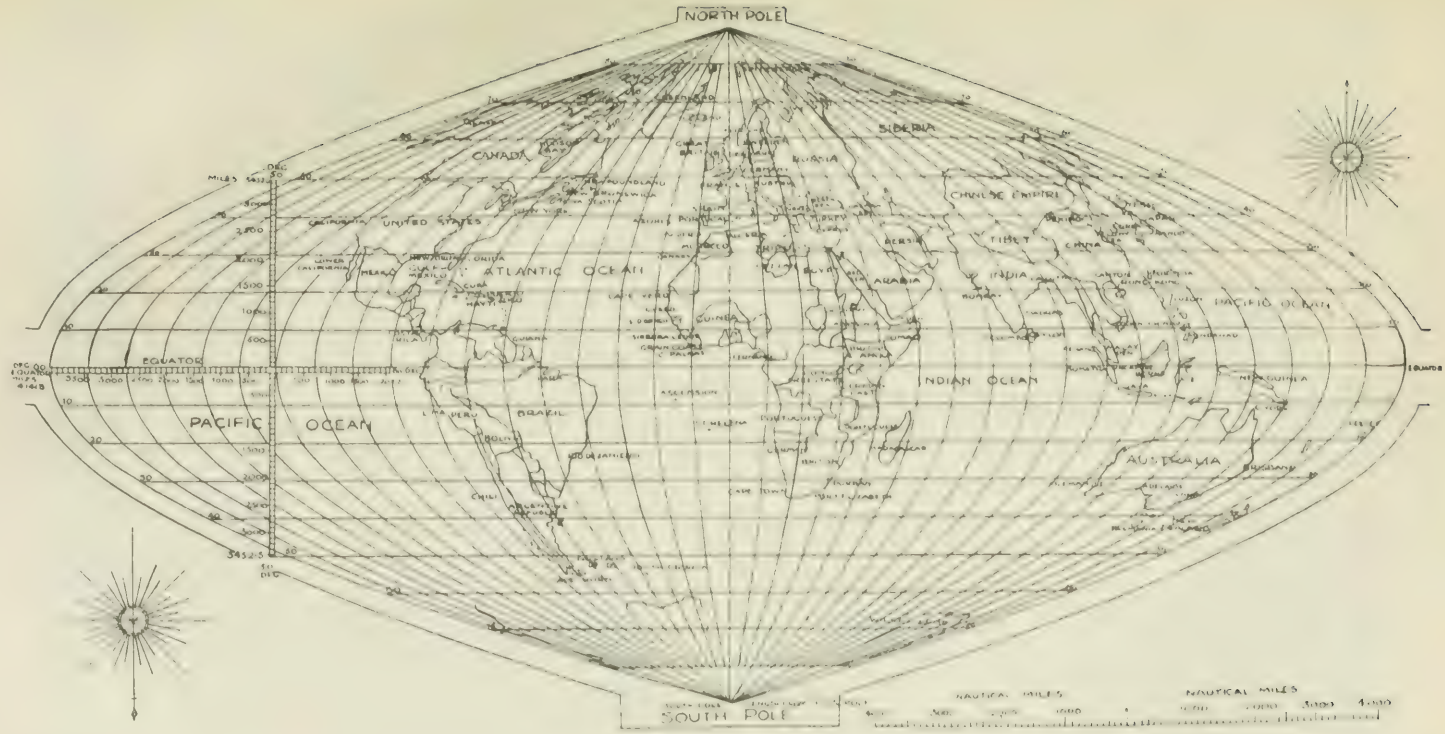


FIG. 1.—Graphic Map of the Sphere.

can be considered correct by itself, but only as an average correct within certain limits.

The construction of the graphic map itself is easily described. The major axis of the figure is the length of the Equator, and the minor axis is the semi-circumference from Pole to Pole. The parallels are 10° apart, and are all truly parallel with the Equator, so that each represents the exact circumference of the sphere at its relative distance from the Equator. As the meridians are divided equally on all these circumferences, they must of necessity give the true distances between the meridians all round the world, and they must also agree with the varying distances all round the sphere from the Equator to the Poles. After constructing the map in this way it requires no effort of imagination to see that all the measurements north and south must be true perpendicularly, and those taken east and west must be true horizontally. The only difference is thus with the diagonal lines, and these are combinations of the perpendicular and horizontal lines, which is the natural course. It would not be possible to measure exact diagonals unless the surface represented were perfectly flat; so that with a globular surface, or in anything of the nature of a perspective, we are fortunate if we can find areas correctly by taking two measurements. These naturally fall into groups of (a) latitudes and (b) longitudes. In the case of the latitudes the lengths of the degrees are practically the same from Pole to Pole. The longitudes, however, vary from the full-sized degree at the Equator to a point at the Pole, so that in ascertaining the difference of longitude the mean length of the degree must be found between the points where the distance is required. These distances are generally got by direct measurement on *this* map, but there are tables to be found of all the latitudes and longitudes of the principal places on the globe, and by resorting to these a simple subtraction or addition is all that is required. There are also tables published giving the length of every degree or half degree between the Equator and the Poles, from which the distances may easily be found by simple multiplication. When these distances are known and applied, that is (a) the difference of latitude to the vertical scale, and (b) the difference of longitude to the horizontal scale, the length of the diagonal between the two points will give the true direct distance on the globe.

As to the question of finding the true course of a ship, if the length of the diagonal be found as before described, a parallel line drawn from this to the figure of the compass gives the true direction. It is to be noted that the difference of longitude is marked on the horizontal scale in the *opposite* direction from that to which the vessel is to proceed. In any case the true angle will be found, but if this point of position be not attended to, it may be that the complement or supplement of the angle will be noted instead of the true angle.

This method may be used for any portion of land or water, up to the size of the sphere, with perfect results, in any quarter of the globe. The map is thus very suitable for a nautical chart, and directions or sailing courses may be found on it much more readily than on any existing chart. Mercator's chart cannot be compared with it, as it can

only be used for finding approximate courses in low latitudes, the scales of which are only averages over certain areas, and is useless within the Polar regions.

As illustrative of these new and ingenious features we now give a few examples :—

To measure distance, let us take the two points of 70° S. and 20° W. and 10° S. and 80° W. :—(1) For longitude, from 70° S. 20° W. follow the 20° meridian until it comes to the parallel 10° S. ; measure from this joining point to 10° S. 80° W., and we get . . 4085 miles.

Then from 10° S. 80° W. follow the 80° meridian down until it crosses the 70th S. parallel ; measure from this joining point to 70° S. 20° W. and we get . . 1415 „

This gives a total of . . . . . 5500 „

the mean of which is one half = . . . . 2750 „

(2) For latitude, measure, say, the central meridian between 10° S. and 70° S., and we get . . 4145 „

We fix these two totals on the scale and cross scale, and the diagonal, measured, gives 4974 statute miles, or 4320 knots, which is the *distance*.

To find the *angle of sailing* from Fremantle to Colombo :—We place the mean longitude, 2335 miles, on the scale, starting from 0° eastwards (being the direction *opposite* to the line of sailing), and the difference in latitude, 2695, we place on the cross scale. The diagonal of these—3565 statute miles, or 3095 knots, the length of the course, taken parallel to the compass, gives 49° 5′ north of true west, or 40° 55′ off the true north, which is the *angle of sailing*.

*Equal Area* : Place the net over, say, Australia or New Guinea on each of the maps of this series, and the measurements are all the same. This cannot be done with any other map, sphere or hemisphere. Take Mollweide's as a standard projection : it is something like twenty-three per cent. over the actual area of the globe : *ergo*, if we have, say, Australia at the central meridian in one map, and 50° off the central meridian in the other map, it is an absolute impossibility to measure and find the two totals the same. Yet, Mollweide's is "called" an "equal-area" map. Taking any other projection, we have practically the same discrepancy. In other words, Clark's new graphic maps are the only equal area-maps which stand the test of taking any one area of land or sea, placing it in any position with regard to the central meridian, and finding the area always equal.

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## PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

### Lectures in January.

Mr. J. Y. Buchanan, F.R.S., will address the Society in Edinburgh and Glasgow on the 24th and 26th of January respectively. The

subject of his lecture will be "Observations in and around the Morteratsch Glacier." The lectures will be illustrated by lantern views. Unfortunately Mr. Buchanan will be unable to go to Dundee or Aberdeen. The lecturer for these Centres will be announced later.

## GEOGRAPHICAL NOTES.

### Africa.

**The Forests of Eastern Africa.**—Mr. D. E. Hutchins, Chief Conservator of Forests, British East Africa, has recently retired on pension, and *Nature* takes the opportunity to summarise the work he has been doing during his period of office in Africa. He has demarcated the limits of the beautiful forest which extends from the extreme south of Africa to the equator, along the line of the eastern highlands. The forest changes little in character throughout its extension, but, as the latitude decreases, it ascends higher and higher up the slopes, and new species are added. Thus in the Cape district it comes down to sea-level, in Natal and the Transvaal it is found at 3000, 4000 and 5000 feet, while under the equator it occurs at 7000 to 10,000 feet. It is not, however, quite continuous, differences in climate and topography causing wide gaps. It is best developed on the equatorial highlands of the region which now forms German and British East Africa, where the trees grow with greater vigour than in the south, and where the valuable pencil cedar of Abyssinia (*Juniperus procera*) occurs.

The preservation of this forest is of great importance for the future of Africa, especially of extra-tropical Africa. It forms a dense cover and is slow-growing, forming an ideal water-holding forest. On either side it feeds perennial streams, which themselves feed the rivers. In Natal the preservation of this important forest is now assured, and the Germans in British East Africa are fully alive to its value, but it is stated that in British East Africa there is still danger lest too hasty settlement schemes should lead to its destruction, and thus to the deterioration of the water supply. The fact that forests only cover $1\frac{1}{2}$ per cent. of the area in that region makes the preservation of the few wooded areas all the more important.

### America.

**Recent developments in Brazil.**—By the treaty of Petropolis (1903), Bolivia ceded to Brazil the Bolivian territory of Acre, comprising the sources of the Jurua, Purus and Aquiri (Rio Acre). Since its cession the territory has undergone great development, due especially to the extension of the rubber trade. M. Paul Walle describes the changes which have taken place recently in an illustrated article in the *Bull. Soc. Geog. Comm.*, Paris, and there is also a note, based upon this paper, in the *Annales de Géographie.*

The region was organised by Brazil as a federal territory in three

divisions, corresponding to the three natural regions formed by the river systems mentioned. The great difficulty in development has been that communication is practically impossible except by water, and the streams are only navigable at times of high water, that is from January to May. At other times they are impassable except to Indian pirogues. The distances from civilisation are so enormous that government and trade can only be carried on with the greatest difficulty. Even in a favourable season, for example, it takes thirty days to travel from Senna Madureira, the capital of the Upper Purus, to Rio de Janeiro.

But while communication down the rivers is slow, it exists: on the other hand between the separate divisions of the territory there is practically no communication whatever. The virgin forest separates the headwaters of the three streams, and each region therefore has to develop independently. At best, narrow trails can be hacked out through the forest between the rivers, but the constant liability to flooding makes these of little use, and their construction and maintenance is a matter of great difficulty.

Despite all difficulties, however, the wealth in rubber is causing rapid development. The Brazilian government paid £2,000,000 for the whole territory in 1903, and has already obtained more than 2½ millions in taxes on the rubber exported. The population has also increased, and small townships are springing up.

One of the stipulations in the treaty of Petropolis was that a railway was to be constructed to connect the Madeira and the Mamore, and despite great difficulties good progress is being made with this. Its necessity becomes obvious when we learn that between Porto Velho, above San Antonio on the Madeira, and Villa Bella, at the junction of the Beni and the Mamore, there are no less than twenty-six cataracts in a distance of about 230 miles. These constitute a very serious interruption in the one means of communication, and the object of the railway is to turn the obstacle. Health conditions have presented great difficulties, and it has been found necessary to clear a considerable extent of forest on each side of the proposed line, and to establish ample hospital accommodation. A portion of the line was opened in May 1910, and it is hoped to complete the whole in 1912. The lower terminus, Porto Velho, will then become a true "seaport," though placed far within the land.

## Commercial Geography.

**A Proposed Railway to India.**—According to the *Times* Mr. Charles Black, formerly of the Geographical Department of the India Office, lectured recently to the Royal United Service Institution on a proposed railway from Egypt to India. The line would be 2200 miles in length, and would reduce the time of transit to India from fourteen or fifteen days to eight. The line would start from the bank of the Suez Canal, opposite to Port Said, and would be very direct, following closely the 30th parallel of north latitude. The route offers no insuper-

able topographical difficulties, the chief obstacles being the bridging of the Shat-el-Arab, the Karun, and the marshy ground at the head of the gulf, and the ascent from the lowlands to the Persian plateau. From the northern end of the Suez Canal the line would run south-west to Akaba at the head of the narrow gulf of the same name. Thence it would run eastward to a point equi-distant from Basra and Koweit, where a branch would diverge. In this region the country is stony, not sandy, and averages about 2000 feet above sea-level. The Persian section would pass close to Yezd, Shiraz, and Kerman, the chief commercial places of Central Persia.

## EDUCATIONAL.

**Annual Rainfall of Scotland.**—In the current issue of the *Journal of the Scottish Meteorological Society* (vol. xv. 28) there appears a very valuable article by Mr. Andrew Watt, Secretary of the Society, entitled "The Mean Annual Rainfall of Scotland, 1871-1910." It will be recollected that the subject of the mean annual rainfall of Scotland was elaborately discussed by Dr. Buchan a considerable number of years ago, the records upon which his results were based being those for the years 1866-1890. A considerable amount of material is thus available since his discussion of the subject, and reference to the beautiful coloured map which accompanies Mr. Watt's paper will show that the result has been to produce fairly extensive changes on the map. The interest of both paper and map for teachers in Scotland is very great, and we are glad to notice that copies of the map are available at the price of 16s. per 100, and of the article (with the map), at 2s. per copy. The paper contains a large number of statistics and an interesting discussion on the making of a rainfall map. Applications for either map or paper should be made to the Secretary of the Meteorological Society.

**Photographic Atlas of Land Forms.**—On p. 154 of vol. xxvii. we gave here a short account of the projected *Atlas Photographique des Formes du Relief Terrestre*, in course of preparation under the editorship of Professors Brunhes, Chaix and de Martonne. We have now received the promised specimen part, prepared, as we are informed, somewhat hurriedly, because it was intended that it should be presented to the postponed Geographical Congress at Rome.

The specimen part contains eight phototype plates, and is published by Messrs. Fréd. Boissonnas et Cie, Geneva. Circulars included with it give somewhat fuller details in regard to the scheme than have hitherto been available. The plates of the atlas are to number ultimately 480, but the publication is to be spread over 8 to 10 years, and they will be issued in series consisting of 48 plates, with the accompanying letterpress. The subscription price for the whole issue is 300 francs, but subscriptions at the same rate will be taken for the separate series, *i.e.* 48 plates can be obtained for 30 francs, which works out at a little over

6d. per plate. As yet only 100 subscribers have been obtained, and at least 200 are necessary for the success of the scheme at these rates.

The plates as a whole are to be classified under nine headings, each of which includes a number of sub-groups, so that the whole atlas will constitute a scientific classification of land forms, in addition to giving representations of them. While future parts will contain plates grouped under one heading only, the present one includes plates belonging to no less than seven different groups, so that it gives a very good idea of the general scheme.

Each plate is entirely separate, so that it can be removed and displayed for class use, and no reference letters have been inserted, so that the illustration remains intact and can be employed for any purpose desired. The photographs have for the most part been taken by trained geographers, and have been selected not for their beauty but solely because they illustrate some point of special interest. In most cases the photographer describes the plate, in his own language, but where this language is not French, a French summary has been added in addition. Each plate is enclosed in a sheet of letterpress, which, in addition to the description, usually contains a lettered diagram and a sketch map, and in some cases a section. References are also given, and nothing has been spared to give the plates their maximum usefulness to the serious student. Among those plates which strike us as being of special interest may be named Plate IV., which illustrates surface relief due to faulting, Plate VII., desert relief, and Plate II., which shows the effect of running water on soft and impermeable beds. An examination of these alone, we think, would show that it is difficult to overestimate the value of the atlas alike to teachers and students, and we cordially recommend it to the notice of both, as well as to all those to whom physical geography appeals. Subscription forms are available in the Society's Rooms, where also the specimen part may be examined.

## NEW BOOKS.

### EUROPE.

*The Magic of Spain.* By Aubrey F. G. Bell. London: John Lane, 1912. *Price 5s. net.*

The author calls this "a collection of stray notes on Spain," a description which is rather misleading, for each of those essays is a profound study of some characteristic to be found in that most fascinating of countries. A perusal of them will go a long way to help the reader to understand the phenomena of the history of Spain and her ancient dominions in South America, and the reasons for her decadence. The best part of the book, as it seems to us, is that which deals with the literature of Spain, especially the Modern Spanish Novel. Indeed, since M. Vézinet's *Les Maîtres du Roman Espagnol Contemporain*, there is, perhaps, no book which deals with this subject so thoroughly and with so much discrimination as does *The Magic of Spain*. No one having a knowledge of the language, and wishing to study the literature, could do better than read the chapters dealing with the modern novel. There is no school of fiction at the present time more worthy of serious study than that of Spain.

*Little Cities of Italy.* By André Maurel, translated by Helen Gerard, with a Preface by Guglielmo Ferrero. With 30 Illustrations. New York and London: G. P. Putnam's Sons, 1911. *Price* 9*s. net.*

It is not often that a book by one distinguished author is prefaced by an appreciation and criticism by another, especially when that critic is Guglielmo Ferrero, the historian. M. Maurel started, as he says, on a journey of art, but at once found historical and social questions rising to confront him — what manner of people were these who wrought such wonderful works? In order to understand what, for instance, Florence was at the time of Dante and Petrarch, he studies, not modern Florence, but the girdle of towns round about, with which she was at constant warfare, and which she dominated, notably San Gimignano, Lucca, Pisa, and Arezzo. In the San Gimignano of to-day he sees the Florence of Dante. He writes to show how the various cities fought incessantly for independence and communal autonomy. "Italy formed, as has been so well understood by the historian Ferrero, a federation of rural republics, to which Rome was a bond, but not a mistress." He traces what he considers the disastrous action of one side or the other in calling in foreign help — condottiere, Pope, or Germanic emperor, each in its turn becoming the dominating power, and having to be overthrown; and he indicates that the present house of Savoy represents none other than the old condottiere, the Triplice standing for the old Germanic influence under another form. In the perhaps distant future this reigning house is also to be replaced by a republic, but still the tendency will be for communal autonomy and a federation. It is here that Signor Ferrero respectfully disagrees with him, as will be seen in the very interesting preface. The translation has been done with great skill and good taste.

*Turkey and the Turks.* By Z. Duckett Ferriman. London: Mills and Boon, 1911. *Price* 10*s.* 6*d.*

Mr. Ferriman, while disclaiming any attempt to give a full and comprehensive account of Turkey and the Turks, has managed to compress within the boards of a handy-sized volume of three hundred odd pages a wonderful amount of interesting and informative matter regarding a people who are very much before the world in the present crisis in the affairs of Turkey. The people are of course the Osmanli, the ruling race among the congeries of countries and peoples which go to make up what is known to the outer world by the geographical expression of "Turkey." It perhaps may be worth explaining that this name is not known to, or used by, any of the inhabitants, native or alien, who live under the flag of the Ottoman Empire. The Turks themselves are of course alien in race and creed, and they form a minority in the land which they rule. They come of the Tartar-Turki race which, from its cradle in the highlands of Central Asia, overran the eastern corner of Europe and overthrew the Byzantine Empire; and history shows what an important part they have played in the affairs of Europe in the last five centuries.

Mr. Ferriman's book has the merit of being written by one who knows something of the people he describes, and who is in sympathy with them—too much in sympathy, some readers may think! We find chapters devoted to the origin of the Turks, with a brief history of their wars and conquests in Europe. Others deal with such matters as the harem, dress and homes, slavery, and the faith of the Turks. All of these are brightly and crisply written, and will be found to give a vivid picture of the matters they describe. Considerations of space prevent us from going into detail here, but we may refer to the chapter on the Harem, in which Mr. Ferriman shows that polygamy is the rare exception,

becoming rarer every day, and that the Turks are now practically monogamous. He points out that the word *Haram* in Arabic, or *Harem* in Turkish, means *sacred*, and signifies the part of a dwelling occupied by the feminine portion of a household. To quote :—"It may be the wing of a palace, or it may be the half of a Bedawin tent screened by a goat-hair curtain, but in both cases it is the harem. It is the domain of the wife, like the ladies' bower of the middle ages, or the boudoir of later times." The average Western idea concerning the Turkish harem, Mr. Ferriman points out, arises from confusing it with the seraglio of the Sultans, a widely different institution which is dealt with in a separate chapter.

Reverence for parents and seniors, and care of the aged, are special features of Turkish life, and "the spectacle of the parents in a workhouse with a family of wage-earning children, would be unthinkable. But there are no workhouses in Turkey. Perhaps they will come with 'civilisation.'" Mr. Ferriman says that knowledge of the Turks is a speciality, and that those who profess to know them best are almost invariably newcomers. Unlike many of their Christian subjects, cleanliness with the Turk is a national attribute. "Among men who do not concern themselves with politics, but whose fortune and interests are bound up in the country, the vast majority prefer the Turk to any other denizen of the land for his integrity and trustworthiness." . . . "Turks of the old school, good Mussulmans, are simple in their thoughts and lives. A finer type of man no land can show, and, happily, they are not yet rare." These are the concluding words of Mr. Ferriman's book, and we can heartily recommend it to our readers.

*Things seen in Venice.* By Lonsdale Ragg, B.D. Oxon. and Laura M. Ragg. London : Seeley, Service and Co., Ltd., 1912. *Price 2s. net.*

If there is a city in the whole world, whose varied attractions would mark it as suitable for the "Things Seen" Series, it is Venice ; and the dainty little volume now before us does as much justice to this subject as is compatible with its limits. The authors obviously know Venice well, alike by land and by sea ; they are also familiar with its treasures of art and its once glorious history, and they draw from both, repeatedly and judiciously, to enhance the variety and interest of their subject. Recognising the limits necessarily imposed on them, the authors have made a judicious selection among the innumerable things to be seen in Venice, and their descriptions are calculated to induce the reader to extend his study in so tempting and varied a field. As usual in this beautiful illustrated series, the photographs will probably be the principal attraction of the book in the case of many readers.

*Rambles Around French Châteaux.* By Frances M. Gostling. With 5 Illustrations in Colour and 33 from Photographs. London : Mills and Boon, Ltd., 1911. *Price 6s.*

This book is of a type which is common, but in charm and spirit it is quite out of the common. Mrs. Gostling is known already as the writer of *The Bretons at Home*, and other books on France. She tells here of a motor trip with her husband which took them from Havre, past Paris, through Auvergne to Arles, then to Foix and so north by Touraine to St. Malo, most of the country being well known to her previously. Concentrating her interest on the Châteaux—though the Cathedrals are not forgotten on the way—she gives their story in vivid and picturesque style—witness her description of the often-told murder of Henry of Guise in the Château of Blois ; and she varies her narrative by well-chosen quotations from the old chronicles. Her art in re-peopling the old rooms strikes

one as specially fine, grounded as it is on genuine historical knowledge, and combined with it is her zest in personal incidents, such as her experiences at Chateauneuf-du-Pape. Popular legends have much attraction for her, and are sympathetically told. The illustrations are excellent, and we ought to mention specially the delightful photograph of Frédéric Mistral. A useful index completes a volume of exceptional interest. Even those who have visited the places mentioned will probably find new information. How many for instance who have passed along the road through the noble Gorge of Pierre-Lys are aware that it is the work of a humble village priest?

*In the Heart of the Vosges, and other Sketches by "A Devious Traveller."* By Miss Betham Edwards. 16 Full-page Illustrations. London: Chapman and Hall, Ltd., 1911. *Price* 10*s.* 6*d. net.*

The chapters relating to the Vosges occupy less than half the book, and the "Other Sketches" include "Toulouse," "My Pyrenean Valley at Last," "An Olive Farm on the Var," etc. We notice, however, that the headings have sometimes but a limited connection with the subject-matter.

Miss Betham Edwards's pleasant writing about the pleasant land of France is well known, and this collection of articles, old and new, maintains the standard to which she has accustomed us.

*My Italian Year.* By Richard Bagot. Illustrated. London: Mills and Boon, Limited, 1911. *Price* 10*s.* 6*d. net.*

This is not a book of travel, nor emphatically is it a guide-book. It represents the experience and jottings of a writer who has made Italy his home, and has learned to know and love the people. He is very conscious of the gulf which exists between the Anglo-Saxon and the Latin, and the difficulty that the one has in understanding the other. It is possible that he overestimates this want of compatibility, but it is just the effort to bridge the gulf which makes the book so interesting. He deals with many questions which rise in the mind of the thoughtful traveller, such as the relations of the Roman Church to the people, and the Vatican and its prisoner in relation to the Government, and apparently speaks with authority. The descriptions of social life in the various centres are very racy. The one blot is the author's obvious animus against his own countrymen and women. How he does scold! We have a feeling that the Latin, who is very observant and has an amazing power of intuition, may understand our good and bad points better even than Mr. Bagot. Are we all such ignorant "bounders" after all? But he is no less hard on the Americans, and there is a good story of a German lady who succeeded in penetrating into the most crowded and solemn functions at St. Peter's by means of a bonnet-pin concealed in her muff with which she prodded the backs of the faithful—an excellent method, requiring some nerve for its effective use.

## ASIA.

*Java, Sumatra, and the Other Islands of the Dutch East Indies.* By A. Cabaton. Translated and with a Preface by Bernard Miall. London: T. Fisher Unwin, 1911. *Price* 10*s.* 6*d. net.*

Every Scotsman ought to take an abiding interest in Java, if only for the sake of John Leyden. Sir Stamford Raffles, in his introduction to Leyden's translation of the *Malay Annals*, says, "from the period at which Dr. Leyden first

visited the Eastern Islands in 1805, he may be said to have espoused the cause of the Malayan race with all the ardour and enthusiasm which so peculiarly distinguished his character." And yet most of us know very little about this great and interesting country with its thirty odd million inhabitants. We therefore welcome this exhaustive and eminently readable book. Not the least important part of it is the historical introduction by the translator, Mr. Bernard Miall. After reading all that is suggested about the origin of the Javanese, it remains probable that these races as we find them are the result of successive waves of conquest from the far north, mingled with Polynesians and others. A fruitful suggestion is that Java for many centuries was looked on by adventurous spirits in India as an Eldorado teeming with boundless wealth, very much as Brazil was to the Portuguese, and that quite apart from the great prehistoric Mongolian eruptions, expeditions poured in from various parts of India carrying their traditions, religions, and handicrafts. M. Cabaton gives a favourable, and, we believe, a very fair account of the results of Dutch domination. They made their mistakes, and the history of the old Dutch East India Company is extremely unsavoury with its evil system of forced culture, but not only did Sir Stamford Raffles during his short tenure abolish this system, but the Dutch themselves, when they returned to power, loyally carried on his policy. Not very much, the author says, can be said against a government which spends more than £1,000,000 annually on the pensions of notables and the salaries of native officials, and more than £280,000 on the education of these very natives, more on agriculture than on a military establishment. Great Britain has naturally felt rather sore that we did not retain possession of these islands, but it must be remembered that we did get compensation in the Malay Peninsula, which has done not so badly, and that Java is in the hands of a friendly power which has a history not unlike our own, and which is fully alive to its responsibilities.

*The Chinese at Home, or the Man of Tong and His Land.* By J. Dyer Ball, I.S.O., M.R.A.S. London: The Religious Tract Society, 1911. *Price* 3*s. net.*

Mr. Dyer Ball, who is a veteran of the Hongkong Civil Service and well qualified to write on his subject, tells us that he has dwelt among "the Men of Tong" for more than forty-six years, during which time he has studied their manners, customs, language, and thoughts; and his story of some of the many phases of Chinese life is contained in the volume before us. It necessarily covers much ground which has already been made familiar by Dr. Wells Williams in his *Middle Kingdom*, by the Abbé Huc in his *Empire Chinois*, and by a host of other writers less known to fame, but it contains the fruit of much independent observation, and will be found to be a mine of information for those who wish to study the domestic life of the Chinese. It is not possible in the compass of a brief notice to refer to more than one or two of the leading features in Mr. Dyer Ball's interesting study. Perhaps one of the best chapters is that which deals with "the life of a dead Chinaman":—

"In China, strange in so many of its customs and so many of its ideas, the dead rule the living in thought; they rule them in custom; they rule them throughout their lives, by fear and dread of calamity, if everything is not done to propitiate them—an obsession at times too awful for words."

The people have a proverb which says, "the most important thing in life is to be buried well," and there can be no question that one of the most potent causes of the reverence for and worship of the dead is to be found in this fear of disembodied spirits, and of the unpleasant consequences which may arise from offending

them. The author believes that a sense of filial piety is a real factor in the Chinese ancestral worship, but he rightly attributes part of the elaborate cult which accompanies their reverence for the dead to *olo custom*, the latter being a useful pidgin-English expression which furnishes the reason for many of the conventions of Chinese life.

We should also draw attention to the chapters on Geomancy, or *Fung Shui*, and on the opium question. Mr. Dyer Ball affirms with truth that the so-called "opium wars" with Great Britain would have taken place sooner or later—opium or no opium—on account of the arrogance and obstructiveness of the native officials. Speaking of the obstacles to the spread of Western knowledge, he emphasises the difficulties which arise to its dissemination through the Chinese book-language differing so widely from the speech of the people. It is as if English school-books were written in the language of Chaucer or Piers Plowman; added to which we have to reckon with the complex character of the Chinese ideograph itself. "Sooner or later," Mr. Dyer Ball says, "this beautiful but cumbrous language will have to burst its bonds of antiquity and appear afresh in alphabetical form." We can cordially recommend this book to the notice of readers of the *Magazine*.

*Pilgrims to the Isles of Penance: Orchid Gathering in the East.* By Mrs. Talbot Clifton. London: John Long, 1911. *Price* 12*s.* 6*d. net.*

This book which, the author tells us, is the first-born of her pen, opens with a tribute to her husband, Mr. J. Talbot Clifton, who seems to have done much genuine exploring work in the Arctic, in Siberia, and in Africa. It is the record of a journey made by Mr. and Mrs. Clifton to the Andaman Islands, Burma, Java, and the Malay States. As the sub-title indicates, their quest on the journey was chiefly for orchids, but the orchids are neglected while Mrs. Clifton discourses on many topics, ranging from Christian missions to occultism and theosophy, and her views, we may add, are not always of the conventional order. The description of the Andamans—"the Isles of Penance"—and of the conditions of convict life there, will be found to contain some interesting details regarding places which lie off the beaten track. Mr. and Mrs. Clifton also visited the Nicobars, and we find some curious notes on the practice of *couvade* among the Nicobarians.

Mrs. Clifton says in one place that "the picking of other people's brains is often more productive of rubbish than rag-picking," and some of the stories she recounts as to the occult powers possessed by Javanese and others appear to witness to the truth of this dictum. The book is illustrated with some very good photographs.

*India under Curzon and After.* By Lovat Fraser. London: William Heinemann, 1911. *Price* 16*s. net.*

In these days, when from one cause and another a good deal of public attention is being directed to India, the appearance of this portly volume is very welcome. Without entering into controversial matter, of which there is plenty in its contents, we may remark that a perusal of it conveys a better idea of the duties and responsibilities of a Viceroy than any book on India which has come under our observation of late years. Mr. Lovat Fraser in his capacity of editor of the *Times of India* had special sources of information and opportunities of observation of public affairs in India throughout the period of Lord Curzon's viceroyalty, and he has used them in this work for the information of the public in a form which is at once judicious and attractive. The majority of the actors in the scenes which

he depicts are still alive, and we doubt if any of them would take exception to the good taste of anything that is written in this book, and this although Mr. Fraser has strong views of his own which he does not hesitate to express and support with cogent reasoning. A practised journalist, he has a graphic pen and a fluent, incisive style, and he has also an enthusiastic admiration for the hero of his book, which, however, does not prevent him criticising freely the action or the policy of the Viceroy, when he thinks that either the one or the other was mistaken. But, on the whole, Mr. Fraser is a thoroughgoing admirer of Lord Curzon, and makes no attempt to conceal the fact. He explains (we should add) that during the Viceroy's tenure of office he had no communication with him on public affairs. Limitations of space prevent us from doing more than indicating a few of the many important matters which are described and discussed in this book—matters on some of which volumes have been or might be written. With regard to foreign policy Mr. Fraser gives his readers an interesting account of the formation of the North-Western Frontier Province and the expedition to Lhasa in Tibet, besides discussing innumerable and intricate questions regarding our relations with Afghanistan and the frontier tribes, and also regarding the relations of India with European powers in the Persian Gulf, the mismanagement of any one of which would have entailed war or, at the very least, a serious loss of prestige.

Among the problems of domestic policy with which Lord Curzon's name is inseparably connected is the partition of Bengal, a policy which has now been reversed; the thorough reform of the system of education, the reform of the system of assessment of the land revenue, the extension of canal irrigation and railways, the institution of agricultural banks, the reform of the police, etc. While engaged in these perplexing problems he had to combat the calamities of famine and plague, severer than had ever been known in the history of India. Lord Curzon was fortunate in one respect. During his tenure of office his exchequer was always full, and he was never hampered like his predecessors for want of funds. The circumstances which led to his premature resignation are described and discussed in some detail by Mr. Fraser with every desire to be impartial to Lord Kitchener, Lord Curzon, and the Home Government, but this is obviously a question of *la haute politique* which cannot be discussed in the pages of this magazine.

We trust we have said enough to commend this thoughtful and instructive work to our readers. It is full of varied and interesting matter, and depicts the burdens and cares which fall to the lot of an Indian Viceroy with discrimination and due sense of proportion. It should tend to create sympathy with and consideration for the holders of that high office, and should go far to stem the stream of ignorant and malicious carping and criticism emanating from some quarters at home, the sole results of which are to increase the difficulties of the work of a Viceroy and to weaken his authority. It should also convince every impartial mind that British rule, on the whole, has been and is an unalloyed blessing to the hundreds of millions of our Indian subjects, and that for years to come the prosperity of India is bound up with British rule.

*Turkestan: The Heart of Asia.* By William Eleroy Curtis. London: Hodder and Stoughton, 1911. *Price* 12*s. net.*

This volume is merely a reprint of a series of letters written in 1910 for some Chicago newspapers. The writer makes frequent reference to the condition and prospects of foreign traders in Turkestan, and is much gratified to find that American manufactures are so much used there. He takes various opportunities of con-

trasting the administration of Russia in Turkestan with that of Britain in India, in order to point out how much the British have to learn from the Russians in the art of government. His opinions, however, cannot fail at times to evoke a smile, as when he announces that "Islam is a dying religion," or that the narrative of Gonzalez de Clavijo "from a historical point of view is exceedingly important, almost equal to the narratives of Marco Polo and *Sir John Mandeville*"! or that in legal matters "the Mussulman code, which is simply the Koran, answers all the needs of Mussulman communities." His political acumen may be gauged by his statement that "the friendly protocol between the Czar and the King of England has not caused any change in the Czar's determination to annex Persia, Manchuria, and ultimately India, to his empire." These letters may have had an ephemeral interest to Chicago readers as they came out, but they were not worth reprinting. The illustrations are good.

*My Experiences at Nan-Shan and Port Arthur.* By Lieutenant-General N. A. Tretyakov. Translated by Lieutenant A. C. Alford, R.A. Edited by Captain F. Nolan Baker, R.A. London: Hugh Rees, Ltd., 1911. *Price* 12*s.* 6*d. net.*

Possibly some of our readers are so interested in the famous siege of Port Arthur that they are not content with the account of it in the voluminous official history of the Russo-Japanese War. To such we heartily recommend the remarkable volume now before us, which tells in graphic and vivid detail the part taken by the Fifth East Siberian Rifles in the defence of Port Arthur. The story was told originally in a series of twelve articles which appeared in a Russian journal, and were contributed by Lieutenant-General Tretyakov, and have now, with his consent, been translated into English and published. During the siege of Port Arthur, General, then Colonel, Tretyakov was in command of the Fifth East Siberian Rifles, and he gives us an excellent account of what happened from a Russian officer's point of view. The book is furnished with several good maps with the help of which the non-military reader can generally follow the various operations. Into the details of these we cannot enter. Incidentally we learn how grievously mistaken was the Russian estimate of their opponents' strength both by land and sea, how in many ways they were unprepared for the siege, and how much the military administration in the Fort left to be desired. The appearance of such outspoken criticism in a St. Petersburg military journal shows that a considerable licence is extended to Russian officers in the publication of their observations and opinions.

*Stalks in the Himalaya: Jottings of a Sportsman-Naturalist.* By E. P. Stebbing, F.R.G.S., F.Z.S. London: John Lane, 1911. *Price* 12*s.* 6*d. net.*

We imagine that most readers of *Jungle Bye-ways in India*, which was noticed in the *Magazine* for January 1911, will welcome the appearance of Mr. Stebbing's new book on Indian shikar. The various kinds of large game found in the Himalaya are dealt with under appropriate sections—*e.g.*, Deer, Bears, "Cats," Goats, and Sheep, each after its kind. These are all handled with the feeling of a true sportsman, and what Mr. Stebbing has to tell will be found to be well worth reading. He points out that to get the great sheep of the Pamirs, the *Ovis poli*, means a longer and more arduous expedition than he undertook. The author has a happy knack of bringing the atmosphere of the hills into his pages, as is shown by the following quotation:—"The keen morning air and the stiff climb send the blood coursing merrily through the veins, and one feels in tune with the glorious scene around one. Are we not many, many miles distant from the scorching plains, right

up amongst the most glorious scenery the world contains, in the mightiest of mountains, the Himalaya? Around one the beautiful deodar forest clothes the steep mountain side, the graceful and handsome shape of this beautiful tree giving the woods more the appearance of a well-kept ornamental plantation at home than of a large forest worked on commercial principles. Here and there as one tramped up the hill a small opening would give one a *coup d'œil* of distant snowy peaks framed in a setting of the tender, green, tassely, pendant deodar branches, backed by the vivid blue of an Indian sky."

It appears strange to read of the red bear having poor *oral* powers; but this is possibly a misprint for aural.

## AFRICA.

*Reise durch das Hinterland von Liberia.* Von Dr. Walter Volz. Nach seinen Tagebüchern bearbeitet von Dr. Rudolf Zeller. Bern: A. Francke, 1911. *Price M.* 4.50.

This small volume is an important addition to the as yet somewhat scanty literature on the geography of Liberia. It has farther interest as an evidence of the remarkable character of a born naturalist and explorer. Dr. Rudolph Zeller has here arranged and edited the diaries which were sent home by the French authorities after Dr. Volz' tragic death at the hands of the natives at Bussamai on 2nd April 1907. The diary begins at 26th November 1906, and the last entry here given is from March 1907.

In comparison with the adjacent regions of Sierra Leone, the Ivory Coast, and even Nigeria, the district of Liberia (the Pepper Coast) is but little known. This has been owing to the peculiar political conditions. The Pepper Coast was selected by the American Colonisation Society to receive the freed slaves in 1821. The Society had difficulties, not only with native chiefs, but with the authorities —French and English—of the neighbouring "spheres of influence," and it was not till 1908 that the boundaries of Liberia were definitely settled.

Volz' diary is made up of graphic descriptions, illustrated by photographs, of the country he traversed in the Hinterland, and of the conditions of life he found there. He gives striking pictures of typical personalities whom he met—chiefs, native porters, men, women and children. The stage of civilisation reached is low: superstition is still in full sway, and one is face to face with the children of the American slaves, the only improvement in whose condition is that they are free.

One of the largest settlements in the interior is Loma. Long before he reached it, the explorer had heard of it as a "huge city." It was said to have twenty-four gates and to contain representatives of every race in West Africa. He was told he would there find horses and see large markets. The chief was spoken of as a "real king." Volz was disappointed. Instead of a "huge city" well laid out, he found a typical negro village, not to be compared even to Timbuctoo! He was amazed—not at the size or importance of Loma, but at the merciless exaggerations of his native informants.

The book contains two excellent maps, and numerous first-rate photographs.

## AMERICA.

*Across South America: An Account of a Journey from Buenos Aires to Lima by Way of Potosi.* By Hiram Bingham, Yale University. With 80 Illustrations and Maps. London: Constable and Co., Limited, 1911. *Price* 12*s.* 6*d. net.*

Interest in this book will be heightened by the notice which has lately appeared in the newspapers that Prof. Bingham has made the discovery of

extensive ruins of a city belonging to the Inca civilisation, ruins which he considers the finest yet brought to light in that country. The old trade routes across South America must always command our interest, because from the time of the discovery of the country, and its fabulous wealth of gold and silver, they have been the scenes of enterprise and adventure, and of many a bloody fight. Prof. Bingham, on his way to Chile, traversed the old route across the mountains through Potosi and its silver mines to Antofogasta on the west coast, returning by way of Lake Titicaca, exploring, as he says, the most historic highway in South America, the old trade route between Lima, Potosí, and Buenos Aires. All this Prof. Bingham sees with the eye of a trained observer deeply read in the history of the country. It is obvious that he was continually on the look-out for further evidences of the ancient civilisation of the Incas, and we heartily congratulate him on the success which is reported to have attended his efforts. With all this he does not lose sight of the material interests of his own land, never failing to draw attention to the possibilities of trade expansion.

## BOOKS RECEIVED.

*Forecasting Weather.* By W. N. Shaw, F.R.S., Sc.D. Fully Illustrated with Maps, Charts, and Diagrams. Demy 8vo. Pp. xxvii + 380. *Price* 12*s.* 6*d. net.* London: Constable and Co., Ltd., 1911.

*Arabic Self-Taught (Syrian) with English Phonetic Pronunciation.* By A. Hassam. Enlarged and Revised by the Rev. N. Odeh. Fourth Edition. Cr. 8vo. Pp. 128. *Price* 2*s.* 6*d.* London: E. Marlborough and Co., 1911.

*A Woman's Winter in South America.* By Charlotte Cameron. Cr. 8vo. Pp. 292. *Price* 6*s. net.* London: Stanley Paul and Co., 1911.

*A Journalist in the Holy Land: Glimpses of Egypt and Palestine.* By Arthur E. Copping. Illustrated by Harold Copping. Demy 8vo. Pp. xiv + 248. *Price* 5*s. net.* London: The Religious Tract Society, 1911.

*Palestine, Depicted and Described.* By G. E. Franklin, F.R.G.S. Illustrated with 376 Photographs by the Author. Demy 8vo. Pp. xx + 219. *Price* 10*s.* 6*d. net.* London: J. M. Dent and Sons, Ltd., 1911.

*'Twixt Sand and Sea: Sketches and Studies in North Africa.* By Cyril Fletcher Grant and L. Grant. Demy 8vo. Pp. xii + 504. *Price* 21*s. net.* London: Sampson Low, Marston and Co., Ltd., 1911.

*Panama: the Canal, the Country, and the People.* By Albert Edwards. Illustrated. Cr. 8vo. Pp. x + 585. *Price* 10*s.* 6*d. net.* New York: The Macmillan Co., 1911.

*The Making of Northern Nigeria.* By Captain C. W. J. Orr, R.A. With Maps. Demy 8vo. Pp. x + 306. *Price* 8*s.* 6*d. net.* London: Macmillan and Co., 1911.

*With Ski in Norway and Lapland.* By J. H. Fulton, B.A. With Introduction by G. Herbert Fowler, Ph.D., F.L.S., and numerous Illustrations from Photographs taken by the Author and others. Cr. 8vo. Pp. xv + 254. *Price* 5*s. net.* London: Philip Lee Werner, 1911.

*Forest Physiography: Physiography of the United States and Principles of Soils in Relation to Forestry.* By Isaiah Bowman, Ph.D. First edition. Demy

8vo. Pp. xxii + 759. *Price* 21*s. net.* New York: John Wiley and Sons, 1911.

*The Land of Uz.* By Abdullah Mansûr (G. Wyman Bury). With Illustrations. Demy 8vo. Pp. xxviii + 354. *Price* 8*s.* 6*d. net.* London: Macmillan and Co., 1911.

*Beyond the Pir Panjal: Life among the Mountains and Valleys of Kashmir.* By Ernest F. Neve, M.D., F.R.C.S. (Edin.). Demy 8vo. Pp. xvi + 320. *Price* 12*s.* 6*d. net.* London: T. Fisher Unwin, 1911.

*Mission Pavie Indo-Chine* 1879-1895: *Géographie et Voyages. VI. Passage du Mé-Khong au Tonkin* (1887 *et* 1888). Par Auguste Pavie. Avec quatre cartes et soixante-dix neuf Illustrations. Demy 4to. Pp. 348. *Price* 10 *fr.* Paris: Ernest Leroux, 1911.

*The Guide to South and East Africa, for the use of Tourists, Sportsmen, Invalids and Settlers.* With Coloured Maps, Plans, and Diagrams. Edited annually by A. Samler Brown and G. Gordon Brown. 1911-12. Eighteenth Edition. Cr. 8vo. Pp. xliv + 492. *Price* 2*s.* 6*d.* London: Sampson, Low, Marston and Co., Ltd., 1911.

*How to see Italy by Rail.* By Douglas Sladen. With 160 Illustrations from Photographs by the special Photographer and Dorothy Ridly. Cr. 8vo. Pp. xxvi + 566. *Price* 7*s.* 6*d. net.* London: Kegan Paul, Trench, Trübner and Co., Ltd., 1912.

*Through Polynesia and Papua: Wanderings with a Camera in Southern Seas.* By Frank Burnett. Illustrated. Demy 8vo. Pp. xv + 197. *Price* 12*s.* 6*d. net.* London: Francis Griffiths, 1911.

*Monmouthshire* (*Cambridge County Geographies*). By Herbert A. Evans, M.A. With Maps, Diagrams, and Illustrations. Cr. 8vo. Pp. ix + 183. *Isle of Man.* By the Rev. John Quine, M.A. With Maps, Diagrams, and Illustrations. Cr. 8vo. Pp. x + 178. *East London.* By G. F. Bosworth, F.R.G.S. With Maps, Diagrams, and Illustrations. Cr. 8vo. Pp. x + 256. *Price* 1*s.* 6*d. each.* Cambridge: University Press, 1911.

*La Sismologie Moderne* (*Les Tremblements de Terre*). Par le Comte F. de Montessus de Ballore. 64 figures et cartes dont 16 planches de reproductions photographiques et 2 cartes hors texte. Cr. 8vo. Pp. xx + 284. *Price* 4 *fr.* Paris: Libraire Armand Colin, 1911.

*Fourth Report of the Wellcome Tropical Research Laboratories at the Gordon Memorial College, Khartoum.* Vol. A. Medical. By Andrew Balfour, M.D., B.Sc., F.R.C.P.Edin., D.P.H.Camb. *Price* 21*s. net.* London: Published for Department of Education, Khartoum, by Baillière, Tindall and Cox, 1911.

*The Canada Year-Book*, 1910. Second Series. Ottawa, 1911.

*Whitaker's Almanack*, 1912. *Price* 1*s.* and 2*s.* 6*d.* London, 1911.

*Who's Who?* 1912. London: A. and C. Black, 1911.

*Diplomatic and Consular Reports.*—Trade and Navigation of the Port of Dairen, 1910 (4789); Trade of Smyrna, 1910-11 (4809); Trade and Commerce of the Philippine Islands, 1910 (4810); Trade and Commerce of Bunder Abbas, 1910-11 (4811); Trade and General Condition of the City of Barfrush and the Province of Mazanderan, 1910-11 (4812); Trade of Paraguay, 1910 (4814); Trade and Commerce of the district of Senggora, 1910 (4815); Trade of St. Thomas and St. Croix, 1910 (4816); Trade of Bulgaria, 1910 (4817); Trade and Commerce of French Guiana, 1910 (4818); Trade of the district of Dunkirk, 1910 (4819).

*Colonial Reports.*—Swaziland, Report for 1910-11 (697); Bechuanaland Protectorate, Report for 1910-11 (696); Southern Nigeria, Report for 1910 (695).

*Colonial Import Duties*, 1911. Return relating to the rates of import duties levied upon the principal and other articles imported into the British Self-Governing Dominions, Crown Colonies, and Protectorates.

*Publishers forwarding books for review will greatly oblige by marking the* **price** *in clear figures, especially in the case of foreign books.*

## NEW MAPS.

### EUROPE.

**ORDNANCE SURVEY OF SCOTLAND.**—The following publications were issued from 1st to 31st October 1911 :—

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**GEOLOGICAL SURVEY OF SCOTLAND.**—The following publication was issued from 10th to 30th November 1911 :—

One-inch Map. New Series. Colour Printed, solid and drift editions. Sheet 65. Price 2s. 6d. The solid is shown in colour, the drift by symbols in black.

**GEOLOGICAL SURVEY OF SCOTLAND.**—Scale 1 : 63,000 or 1 inch to a mile. *Glasgow District.*—Parts of Sheets 30, 31, 22, 23. With Sections. 1911. Printed in colours. Price 2s. net.

*Presented by the Board of Agriculture and Fisheries.*

A most useful publication for Glasgow students as it comprises the Glasgow portion of four separate survey sheets.

**SCOTLAND.**—Bartholomew's Quarter-inch to Mile Map of Scotland. With Orographical colouring and roads. Sheet 1.—*Sutherland and Caithness.* 1911. Price 1s. 6d. Mounted on cloth 2s.

*John Bartholomew and Co., Edinburgh.*

This sheet completes the issue of this useful motoring map of Scotland.

**LANARKSHIRE.**—School Wall Map. Scale 1 : 63,000 or 1 inch to a mile. Constructed and engraved by W. and A. K. Johnston, Limited. Size 50 × 42 inches. Price 12s. mounted on cloth, rollers, and varnished.

*W. and A. K. Johnston, Limited, Edinburgh and London.*

This map is orographically coloured. The topography is clear and distinct, the parishes are marked in red, and altogether it is an excellent map for teaching purposes.

**MEDITERRANEO.**—Carta Politica de Paesi del ——. 1911. Alla scala media di 1 : 6,750,000. Prezzo L. 1.00.

**TRIPOLITANIA.**—Carta Dimostrativa della ——. Alla scala di 1 : 5,000,000. Prezzo L. 0.50.

**TRIPOLITANIA E CIRENAICA.**—Nuova Carta della ——. 1911. Alla scala di 1 : 5,000,000. Con cartine speciali alla scala di 1 : 2,000,000, costruita e disegnata da A. Dardano. Prezzo L. 0.60.

*Istituto Geografico de Agostini, Novarà.*

These are most excellent maps adequately illustrating the situation in Tripoli.

## AFRICA.

**AFRICA.**—Carta Politica, 1911. Alla scala di 1 : 24,000,000. Prezzo L. 0.60.

*Istituto Geografico de Agostini, Novara.*

This patriotic little map is first in the field to display Tripoli as an Italian Possession, but it has not taken time to show Morocco as a French sphere, or to mark the German acquisitions in the French Congo.

**UGANDA.**—Scale 1 : 250,000, or 4 miles to an inch. 1911. Sheets, Entebbe, Hoima. Price 2s. each sheet.

*Geographical Section, General Staff, London.*

**NORTHERN NIGERIA.**—Scale 1 : 62,500 or about 1 inch to a mile. Sheet, Liruen Delma. 1911. *Geographical Section, General Staff, London.*

## AMERICA AND AUSTRALIA.

**NORTHERN ONTARIO.** The Mineral District. Scale 1 : 250,000 or about 4 miles to an inch. Two sheets. R. E. Young, D.L.S. Chief Geographer. 1911.

*Department of the Interior, Ottawa.*

A valuable new map showing the allotments in this newly opened up country.

**QUEENSLAND.** Mining Maps.

**Cape York Peninsula.** Gold and Mineral Fields. 1911. Scale 6 miles to an inch. Price 1s. 6d.

**Charterhouse Goldfields.** 1911. Scale 4 miles to an inch. Price 1s. 6d.

**Croydon and Etheridge Goldfields.** 1911. Scale 6 miles to an inch. Price 1s. 6d. *Brisbane Geological Survey Office.*

## ATLASES.

**WALL ATLAS OF EUROPE.** Philips' Comparative Series, edited by J. F. Unstead, M.A., and E. G. R. Taylor, B.Sc. With Explanatory Handbook for Teachers. Containing 8 Maps on scale of 1:6,000,000 or about 100 miles to an inch. 1. Relief of Land and Communications; 2. Political; 3. Climate—Summer Conditions; 4. Climate—Winter Conditions; 5. Temperature; 6. Natural Vegetation; 7. Economic; 8. Density of Population. Price 27s. 6d. per set, mounted on cloth. *George Philip and Son, Limited, London.*

This admirable series of maps is well planned for practical teaching. All the leading aspects of Europe, in physical, political, and economic geography are effectively displayed. The features are well selected, clearly drawn, and most successfully presented in colour.

**PHILIPS' CHAMBER OF COMMERCE ATLAS.** A Graphic Survey of the World's Trade, with a Commercial Compendium and Gazetteer Index, 1911. Price 6s. net. *George Philip and Son, Limited, London.*

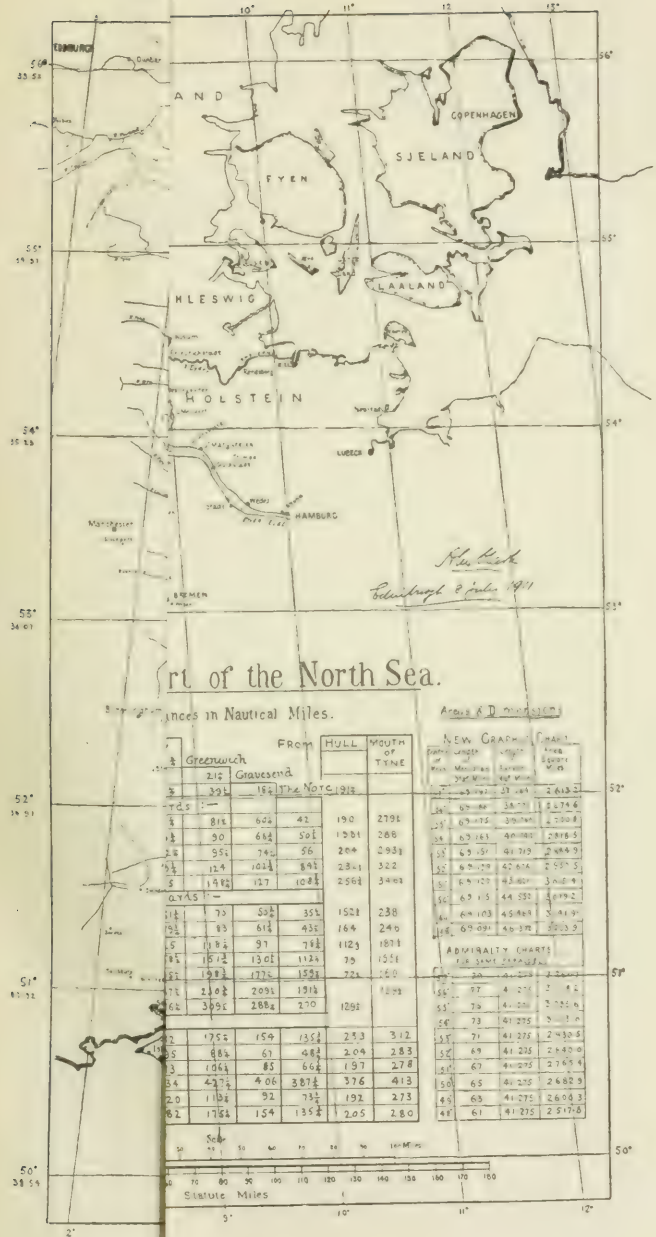
This atlas contains a great deal of valuable information dealing with economic geography. Unfortunately, however, the graphic result is anything but satisfactory, and some of the maps—such as Eastern United States, England, and Germany—are at least perplexing. This is partly the result of attempting to show the distribution of products by simply printing the names over the maps, a method always unsatisfactory, as it gives no definite idea of extent of distribution, and usually leads to great confusion if too much is attempted.

**L'ANNÉE CARTOGRAPHIQUE.** Vingt et unième année, 1911. Dressée et rédigé sous la direction de F. Schrader. Price 3 francs.
*Librairie Hachette et Cie, Paris.*

This issue consists of three sheets of maps and text showing recent explorations and frontier changes in Asia, Africa, and America.

**ATLAS UNIVERSEL DE GÉOGRAPHIE.** Commencé par M. Vivien de Saint-Martin et continué par Fra. Schrader. No. 50. Arabie (Asie en 10 feuilles, No. v.). Échelle de 1 : 5,000,000. Price 2 francs. 1911.
*Librairie Hachette et Cie, Paris.*

**OUTLINE MAPS.** The Visual Series of Improved Contour Outline Maps. Douglas and Philips' Patent. England and Wales, Scotland, Ireland, The Thames Basin, Lancashire, Wales, Scottish Industrial Region, West Yorkshire, Birmingham Industrial Region, Austria Hungary, The Balkans. Price ½d. each. *George Philip and Son, Limited, London.*




# rt of the North Sea.

nces in Nautical Miles.

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| TCS :— | | | | | | |
| ½ | 81½ | 60½ | 42 | | 190 | 279½ |
| ½ | 90 | 68½ | 50½ | | 1581 | 288 |
| ½ | 95½ | 74½ | 56 | | 204 | 293½ |
| ½ | 124 | 102½ | 84½ | | 2361 | 322 |
| 5 | 149½ | 127 | 108½ | | 2561 | 3461 |
| GATS :— | | | | | | |
| ½ | 73 | 50½ | 35½ | | 1521 | 238 |
| ½ | 83 | 61½ | 43½ | | 164 | 240 |
| 5 | 118½ | 97 | 78½ | | 1123 | 1871 |
| ½ | 151½ | 130½ | 112½ | | 79 | 1551 |
| ½ | 198½ | 177½ | 159½ | | 721 | 160 |
| ½ | 210½ | 209½ | 191½ | | | 1893 |
| ½ | 305½ | 288½ | 270 | | 1282 | |
| 2 | 175½ | 154 | 135½ | | 253 | 312 |
| 5 | 88½ | 67 | 48½ | | 204 | 283 |
| 3 | 106½ | 85 | 66½ | | 197 | 278 |
| 4 | 427½ | 406 | 387½ | | 376 | 413 |
| 20 | 113½ | 92 | 73½ | | 192 | 273 |
| 82 | 176½ | 154 | 135½ | | 205 | 280 |

Scale
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Statute Miles

Admiralty Charts

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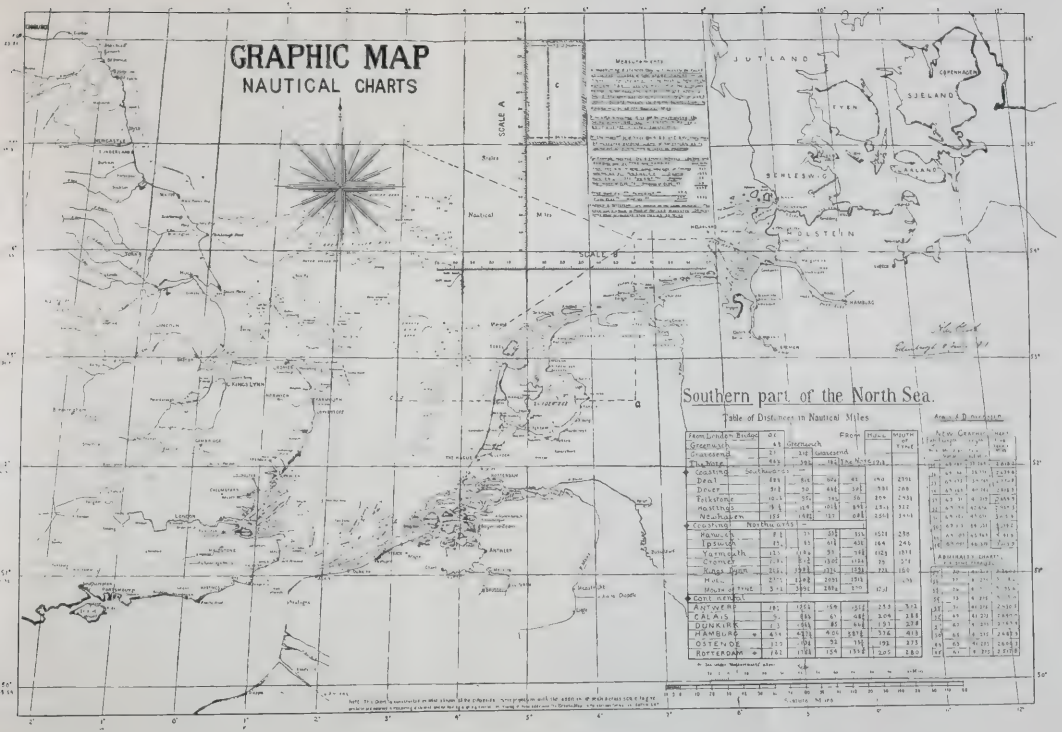
| 53° | 71 | 41 275 | 2 430 5 |
| 52° | 69 | 41 275 | 2 540 0 |
| 51° | 67 | 41 275 | 2 765 4 |
| 50° | 65 | 41 275 | 2 682 9 |
| 49° | 63 | 41 275 | 2 600 3 |
| 48° | 61 | 41 275 | 2 517 8 |


GRAPHIC MAP
NAUTICAL CHARTS
JUTLAND
FYEN
SJELAND
COPENHAGEN
SCALE A
SCALE B
Nautical Miles
HAMBURG
Southern part of the North Sea.
Table of Distances in Nautical Miles

# THE SCOTTISH GEOGRAPHICAL MAGAZINE.

## A BRITISH STATE IN THE MAKING: HOW THE PLAN OF EMPIRE IS FILLED IN.[1]

By Lieut.-Col. the Hon. Sir NEWTON J. MOORE, K.C.M.G.,
Agent-General for Western Australia.

To a Geographical Society such as this the State of Western Australia presents a history and features of interest superior in many respects to those of the eastern States of the Commonwealth. It possesses an unfailing source of geographical interest in the records of the early explorations and voyages along the coastline, for it was very largely the western side of Australia that first came within the ken of the navigator, was charted, reported upon, examined, and constituted the basis upon which the early geographical conceptions of the Southern Continent were formed.

Dirk Hartog, whose name is borne by an island off the coast to this day, was the pioneer of recorded exploration of the western side of Australia. His first visit and examination of the coast—from Sharks Bay northward—was made in the ship *Endracht* (Concord) in 1616, but he was succeeded by a long line of coast explorers. The annals of geography are enriched by the names and exploits of many of these, such as Vlaming, Tasman, Dampier, Pelsart, King, Vancouver, Baudin, and a number of others. Indeed, it would be difficult to name a coastline richer in geographical lore and exploring associations than that of the western side of Australia, but I do not propose at the present time to enter upon a narration—intensely interesting though it may be made—of which others are more capable than myself, and which, to most of the Members of this Society, is a twice-told tale.

I merely allude to these circumstances, by the way, in order to

[1] An address delivered before the Society in Aberdeen on Nov. 7, 1911.

emphasise the fact that despite the knowledge (which existed for more than a century before Cook entered Botany Bay) of at least the coastline of Western Australia, no attempt was made until 1829, or in a small way a year or two earlier, to open up the country for settlement.

Dampier and others condemned the country without penetrating any distance into it, and the Portuguese, Dutch, English and French, who successively visited this great Dominion, allowed it to lie undeveloped and unclaimed. It is singular to reflect that had it not been for the forbidding exterior of the shore-line and its immediate vicinity, the Dutch or the French flag might have floated over half of the Australian Continent—if not the whole of it—at the present day.

These circumstances have greatly influenced the story which I shall tell to-night of the "Advance of Western Australia." The wealth and resources of the State have only slowly become known, and industrial progress is a thing of recent years. You are all aware of the enormous area of the State, covering, as it does, 975,724 square miles, or 624,588,800 acres, and embracing a considerable variety of climates, soils, and conditions. Indeed, it is more than a circumstance of geographical interest that the territory of Western Australia includes a large portion of the two great agricultural zones, the tropical and the temperate.

Its exact situation has been defined as "extending from the parallel of 13° 30′ south latitude, to West Cape Howe in the parallel of 35° 8′ south latitude, and from Dirk Hartog's Island on the western coast, in longitude 112° 52′, to 129° east, including all the islands adjacent in the Indian and Southern Oceans, within the latitudes aforesaid of 13 30′ south, and 35° 8′ south, and within the longitudes aforesaid of 112° 52′, and 129° east."

The greatest length of this territory is 1480 miles, and its greatest breadth about 1000 miles. Now I must say at once that, with regard to a large part of it, we do not know yet the most productive use to which we shall be able to put it, and do not contemplate immediately settling it closely. The north and far north of the State, or, broadly, the tropical portion, is partly suitable at present for pastoral occupation, and some of it is possibly fit for tropical agriculture. Then a large tract of country in the east and north-east of the State is at present chiefly noted for its minerals, although much of it is suitable for horse-breeding and the raising of other stock.

But the development of these portions of the State lies mainly in the future. What the people of Western Australia are concentrating on at present, is the south-western corner of the State, with its agricultural, horticultural, pastoral and timber resources. How the present state in this development has been reached, I shall now proceed to tell.

For sixty years after the establishment of British settlement the advancement of Western Australia was very slow indeed. At the end of that period there were only 46,000 persons in the State, and the total external trade only just exceeded £1,500,000 in value. The pioneers had held on, with fortitude and undying hope, to a country which seemed capable of attracting but a small population, and was not regarded as a profitable field for enterprise. Some of them were, however, not unsuc-

cessful, judged by the modest scale to which fortunes rise in such small communities. They tilled their land and watched their sheep, or cut their timber, untouched by the disturbances of the world without, and if not a rich it was at least a peaceful and moderately contented settlement. Indeed, there were many in those days who saw no advantage in a career of progress and expansion. They argued that they were very well as they were and that an influx of population would only create unrest and fill the country with undesirables. But there had always been a minority of men in whom the spirit of enterprise worked. This spirit manifested itself in many ways, though sporadically and for a long time without much tangible result. It was shown in the prosecution of mineral discoveries as far back as 1842, in the search undertaken from time to time for copper and lead and coal and gold; in the various exploring expeditions which widened geographical knowledge of the continent; and in a steady political agitation which succeeded in securing, first, representative government in 1870, and at last, in 1890, the final goal of responsible government, which was only reached after much baffling and disappointment. Responsible government had been granted to most of the eastern colonies in the middle fifties, and it was only Western Australia which had to fight long and determinedly for this great boon. For such it proved to be.

The old Crown government, and modified Crown government system, possessed some good features; its financial arrangements particularly were in the main sound and excellent. But, after all, nothing can very well compensate a people remote from the centre of Imperial authority for the absence of freedom and power to develop and open up their territory according to their own ideas, to solve their own problems in their own ways. And Crown government, despite some good features, meant in the long run stagnation and want of enterprise. It is true, of course, that the era of responsible government in Western Australia has synchronised with valuable discoveries which have been the touchstone to prosperity. But it is doubtful whether these discoveries would ever have been made had not the knowledge of the gift of self-government attracted new people to the colony, and even if they had been made, it is questionable whether they could have been fully taken advantage of without the existence in the community of the power to provide those substantial facilities for, say, mining operations, in the absence of which all the wealth of Ind may lie unexploited and unused. I have no doubt that the possession of this power has enabled the people of Western Australia to furnish a record of progress within the past twenty-one years, beside which their efforts in the preceding sixty-one years are tame and inexpressibly feeble by comparison. Indeed, few countries have made such rapid advances in a similar period of time. The population has been sextupled, and the revenue and trade have each been multiplied ten-fold.

### The Gold Discoveries.

Gold is the talisman that has attracted population to nearly all the Australian States, and it is a wonderfully potent force.

Governments may do all that it is possible for them to do; they may spend money on immigration and in fostering industries, but the effect of these in attracting people to a new country is slow and expensive compared with the magnetic influence of a rich mineral, and especially of a rich gold discovery.

This was the lode-star of population in Victoria, in New South Wales, and in Queensland; copper mines brought people to South Australia; copper and tin discoveries to the more rugged parts of Tasmania; and it was the gold diggings of New Zealand that made the fertility of that country widely known. And when gold mines draw the people, the character of the rural settlement begins to change. Huge "squattages" where hundreds of thousands of sheep are tended by a few men, give place to wheat and dairy farms, and often to orchards. A large population has to be fed, and farming and gardening, with the prospect of providing its food, become paying occupations. Men who come to look for gold either become tired of a mining life, or amass sufficient capital to seek out some more pleasing and less precarious occupation. Mineral resources dwindle, too, in time, and as the population attracted by them is on the spot, it has to be provided for in some other way. Australia was not close enough to Europe to draw such a large regularly-flowing stream of immigration as filled up the United States, but gold will induce men to cross thousands of miles of sea in great numbers. The eastern States had these experiences in an earlier time; it was late in the day when they came to Western Australia; and when they did come, the western colony had a reservoir of population to draw upon, not so much in Europe, but in the eastern colonies.

Nearly all through the nineties there was commercial depression in the eastern colonies of Australia. First the bank smashes, and then the great drought, caused a disturbance which overthrew many homes and made it difficult for thousands of willing, hard-working men to obtain employment. Eastern Australia's difficulty was Western Australia's opportunity. Payable gold may be said to have been first found in the western State in 1886, although gold was mined long before that, but the rich discovery at Coolgardie was made by Bayley and Ford in 1892, and Kalgoorlie, at first known as Hannan's, was found by the prospectors Hannan and Flannigan in the following year.

For several years onward from that time the mineral development was rapid and continuous, until the gold yield reached a maximum value for one year of £8,770,000, since which it has slightly declined, although there is reason to believe that with the extension of railway and other facilities to outlying fields the output will move upward again.

But in the meantime the gold discoveries had done their work of bringing in a fresh and vigorous population, and ultimately of turning men's minds to the contemplation of the other, and perhaps more permanently productive resources held by the State. The population movement was a rapid one for several years. In 1890, when responsible government was granted, the community numbered 46,000 souls; in the following year there were 53,000; in the year after the discovery of

Coolgardie there were about 9000 arrivals: in the following year there were over 25,000 and less than 10,000 departures. In 1896 there were 55,000 arrivals and only 19,000 departures. And so the tale went merrily on. Between 1890 and 1904 the population rose from 46,000 to 242,000 —all this in fourteen years—and it now stands, seven years later, at about 290,000. But the impetus of the gold discoveries only lasted over the first part of that period. The engine of expansion has, for several years now, been the extension of agriculture and land settlement.

Had not the various Governments which have controlled Western Australia foreseen the necessity of buttressing the mineral development with an agricultural movement, there might have been a very serious commercial depression in the State, but while there was in one or two years some anxiety in business circles, the danger zone has now been successfully passed, and the community is riding triumphantly on a tide of prosperity and progress.

In what does this progress consist? We have seen how it began with mineral discoveries, but one gains only a very faint conception of the character of Western Australia's economic foundations by regarding it as a mineral country. Yet as this was the forerunner and is still the most productive industry, I must say a few words about it.

Indeed, if Western Australia has many other resources, there is no single one for which it is now more famous, and for which, in the future, it is likely to be more distinguished, than for that of its minerals. These are so widely spread, so varied, and in many cases so rich. When I tell you that in an official census of the minerals of Western Australia, prepared under the direction of the Mines Department by Mr. Edward S. Simpson, B.E., F.G.S., in 1904, there were no fewer than 119 varieties listed, many of them valuable for mining purposes, you will understand what a big part its minerals must play in any descriptive account of the State.

Among the chief metals and minerals already worked successfully are gold, silver, copper, tin, tantalite, lead and coal: while there are enormous deposits of hæmatite (oxide of iron). Asbestos is found, and many other minerals of value, and many precious stones, including a few small diamonds, have from time to time been discovered.

But it is gold which looms largest in any consideration of the mineral resources of Western Australia. Altogether, up to July 31st last, £101,362,225 worth of gold had been produced: in 1910 the production was valued at £6,246,848, and dividends to the total amount of over 21 millions sterling have been paid by Western Australian mining companies. The importance of the mining industry to a State of less than 300,000 souls may be gauged by the fact that it employs directly over 18,000 persons. It has, as many will recognise, an indirect value in that it is an industry which especially depends for its successful prosecution on scientific study and skill.

The study of various practical sciences is directly encouraged by the presence of a mining industry in a community, and the flourishing condition, in a scholastic sense, of the State School of Mines at Kal-

goorlie, and the State Technical College in Perth, may be attributed very largely to this factor.

It is interesting to note also that a number of the leading managers and expert men retained in connection with the mines at Kalgoorlie are Australians who have received their initial training in other States of the Commonwealth, and who have signalised their connection with the mines of Western Australia by the introduction of methods and improvements which are, I believe, greatly admired in the mining world. This kind of thing is very valuable in a young community, where for many years it is the avocations in connection with primary production which are mainly followed.

## Other Industries.

My story next leads me from the mining industry to other productions of the State, most of which have a history ante-dating that of serious mining, although their progress has been more remarkable in recent years than formerly. Prominent among these are agriculture, horticulture, wool-growing, stock-raising, pearl-fishing, and timber production. I shall discuss briefly the development of these industries, the chief of which promises to be agriculture, or, more specifically, wheat-growing. A certain quantity of wheat had been grown in the colony from earliest times, and such districts as Northam, York, Newcastle and Beverley have long been famous as grain producers. They are tried and proved districts. But up to 1907 the State continued to import wheat for its own consumption. About that year the policy of the continuous Liberal Government, of which I had the honour to be the head, began to bear fruit. The vast tracts of country east of the Darling Range, thinly covered with salmon gum and having a light loamy soil, had for various reasons not been utilised to any extent for wheat-growing. In new countries there is always a fear of going too far out for agriculture. It was a long time before in South Australia anybody thought it was worth while going north of Gawler to grow wheat, but the best wheat lands of the central State of the Commonwealth now extend hundreds of miles beyond that border line. The history of agriculture in Western Australia has been somewhat similar. In South Australia the penetration of the country by two great gulfs, St. Vincent's and Spencer's, enabled the farmer to market his wheat at an earlier stage of development, for he was not so dependent on the proximity of railways. In Western Australia it was necessary to construct lines of railway into the new agricultural districts in order to make wheat-growing profitable. This has been one of the main lines of policy of successive Western Australia Governments in recent years. Combined with it was a policy of land surveying before selection and settlement and the cheap sale of lands on terms of conditional and gradual purchase, of assisted immigration, and of financial aid rendered at low interest and on easy and long terms of repayment by the Government Agricultural Bank. To state in bare terms of results the effect of these combined policies we have only to quote the progressive figures of wheat production in recent years. In 1901 there were only 74,308 acres under wheat cultivation, and for the

season 1911-12 (eleven years later) there were estimated to be over 800,000 acres devoted to this purpose. The yield, which was 774,653 bushels in 1901, rose to 5,602,368 bushels in 1909-10, and was greater than this in the following year, although owing to some defects in the latter end of the season, it was not so high a result as was expected. Other cereals, especially oats, have advanced rapidly in the area under cultivation and the amount of production. The consequence is, so far as wheat is concerned, that Western Australia from being a few years ago an importing country is now exporting at a rapidly increasing rate.

In the meantime, wool production has also advanced with swift strides. The number of sheep, largely owing to the farming settlement in the south, has advanced from 2,434,000 in 1901 to considerably over 5,000,000 at the present time, and the increase is going on. In 1904 the value of the wool exported from Western Australia was £419,395, while in 1909 it reached £1,013,180, and in 1910, £965,813. Timber exports rose from £511,923 in value in 1907 to £951,306 in 1910.

Pearls and shell, in which a trade has been carried on in Western Australia since 1862, were exported in 1910 to the value of £346,000, by far the highest record in the history of the industry. Copper and tin are also exported in fluctuating quantities.

But I must not forget the fruit industry. A big future lies before the enterprising investor in these lines. The area under orchards and vineyards has now reached about 20,000 acres, and is increasing more rapidly than in any other State of the Commonwealth. During the last two or three years an export trade has been opened up with the United Kingdom and the Continent of Europe in apples, pears, and table grapes. Apples and table grapes from Western Australia have uniform headed the price-list in Covent Garden Market. Western Australia, besides possessing an almost unlimited area of land suitable for the production of all kinds of fruits grown in the temperate zones, is several days of sea-carriage nearer the European markets than any other Australian State, and its climate has the advantages of ripening the fruit earlier in the season, besides bringing the trees and vines more rapidly into maturity.

These figures are a little wearisome, but I am sure you will admit that they disclose a remarkable expansion. Nor is this the whole story. In the Kimberleys, in the far north, there are large herds of cattle for which it is difficult at present to find a market, but this problem will be solved in all likelihood by the provision of freezing works at the principal ports of shipment by means of which it is hoped to open up a large and lucrative export trade. When we consider that in the brief space of twenty-one years the total external trade of the State has increased from a value of about £1,500,000 to over £15,000,000, while at the same time advance has been made along a general line including a great variety of products, it surely must be evident not only that the State is rich in resources, but that the people, who number even now less than 300,000 in all, have proceeded to their development with great energy, wisdom, and skill.

## Governmental Problems.

No one who realises the conditions of the country, and indeed of almost any virgin land, will suppose that these results have been achieved simply or easily, or that serious difficulties have not had to be met and surmounted. These problems have been of two classes. One class has been of such a character that the Government alone could meet it; the other has been presented to the individual.

In the first place, the country has had to be explored, and the record of the many exploring expeditions by which the character of the interior of Western Australia has been made known, would in itself fill a volume.

From the earliest days, expedition after expedition has traversed one after another of the vast areas which are comprised in the territory of Western Australia, covering as it does nearly a third of the Australian Continent.

The work of exploration is still going on; mineral and prospective pastoral areas are being examined, stock routes over enormous distances are being established, and the country is being gradually mapped out for the settler. This is Government work, and it is undertaken with great assiduity and care. Moreover, scientific expeditions,—of which there have been several lately, such as, to mention only two, the Swedish expedition and the Cambridge University Ethnological party, have been attracted to the State by the knowledge that it possesses a unique and ancient flora and fauna, as well as an intensely interesting aboriginal race.

But this exploring work is only a small part of the duty which rests upon a Government in a State like Western Australia. When the eastern goldfields were discovered, there was a serious lack in the areas concerned of suitable drinking and mining water. And there was enormous difficulty in providing, by any means, an adequate supply. It was a work which no private firm or company could have succeeded in, and one which few Governments would have attempted. But the Government of Western Australia, under Sir John Forrest, rose to the occasion, and carried out, at a cost of nearly three millions sterling, a scheme of conservation and pumping, which, in the latter respect at least, has no parallel in the world.

The water is conserved in the Darling Ranges near the coast, by the highest overflow weir in existence, and is thence pumped a distance of 351 miles to a distributing centre on the goldfields. The success of the principal gold mines was largely assured by the construction of this great work. Nor does it stand alone. Railways were built throughout the fields, post and telegraph offices established, dams and wells sunk, public batteries provided, and in a hundred ways the natural difficulties which have confronted the miner and the prospector have been overcome by Government aid. When the wisdom of developing the agricultural industries became clear, the Government of Western Australia again acted with promptitude and resolution.

Railways were constructed throughout the farming areas, and are

still being built; water supply was provided where needed; land was surveyed and cut up into blocks which were sold cheaply to the settler.

The work of land settlement has been proceeding at a prodigious rate during the last few years. In 1909 the area of land conditionally alienated during the year was 1,630,815 acres; in 1910 it was 2,168,206 acres; and for the first seven months of 1911, the area dealt with was 1,082,702 acres. In 1906 there were 1,612 miles of railway line open; in 1910 there were 2,145 miles open, and the work of railway building is going on apace, the construction of 600 miles of new lines having been authorised in the last session of Parliament. At the lowest estimate there is a mile of line in the State at the present time to every 150 persons. But the railways will attract more people.

In a country situated as ours is, they constitute the material basis of progress, for they are the arteries of commerce, without which production would be useless, and there would be no inducement for men to go on the land and till it. I have told you of the assistance also given to the settler through the Government Agricultural Bank, which has been most successful in its operations.

At the date of the last annual report, loans were outstanding from this institution to the amount of £935,960, but repayments were coming in fast, and private banks were rapidly taking over the mortgages of the State Bank. Indeed, the bank, though it has lent money at the cheap rate of 5 per cent., and has lent on the guarantee of improvements made from time to time, has sustained practically no losses at all, and has earned an annual profit which has been put to a reserve fund, which is now equivalent to £3, 6s. 1d. per cent. of the total sum advanced. Thus, while in all these ways the Government has been solving the major problems of the settler, the principles of sound finance have ever been adhered to.

The railways, as a whole, pay their way and yield a considerable profit to the Treasury, while the profits of the trading institutions of the Government as a whole just about cover the total interest on the entire public debt. But it is not alone in these primary and material ways that the Government in Western Australia has done and is doing for the settler what he would have found it impossible or very difficult to do for himself.

Other problems, bearing more indirectly but just as surely on the life of the citizen, have to be met and solved in an advanced community such as ours may well claim to be. To begin with, there is the education of the people. The Government of Western Australia, controlling a community of 300,000 persons, spends £200,000 a year on education. A system of primary instruction which has few rivals anywhere has been provided, and there are schools all over the State, even in its remotest parts; wherever twenty children can be collected, a teacher is sent. Nor is this all. A most efficient State Secondary School, the equivalent of a good Grammar School in Great Britain, has just been opened in Perth, the capital, where there is also an excellent Technical College. A School of Mines has long been established and maintained by the State in Kalgoorlie, and last year a Bill was passed providing for the establish-

ment of a University in Perth, to be supported entirely by the State and to be almost free of charges.

The health of the community has also to be studied; hospitals are provided in various parts of the State; district medical officers are appointed throughout; and under the item "medical and public health" there is an annual expenditure of about £120,000. Grants are also made to literary institutes throughout the country; in Perth an adequate Public Library is maintained, and various literary and scientific institutions are provided with money for their work by Parliament.

The social well-being of the people is studied in many other ways. An Industrial Arbitration Court has been established for many years, and has been perhaps more successful in the settlement and prevention of industrial disputes than any such institution elsewhere, while Factory Acts and Health Supervision Laws provide for the closest care of the people's conditions of employment as well as of their food and other supplies.

The Agricultural Department constitutes a bureau of research, information, guidance, and assistance for the farmer, the fruit-grower, and the primary producer generally, while the extreme care taken in inspection of imports of animals and plants, as well as the practical efforts to combat internal pests, have prevented the introduction and spread of disease among the stock and plants of the State. It will readily be understood that government of this character is no easy task. It is at once imperial and municipal in its range, and it reproduces in a pioneer community, among the bare and unprepared conditions of a virgin land, all the essentials of a high and sound civilisation.

Externally the conditions may be rough and somewhat primitive. There is not a motor-bus at every corner; nor is there the rush and swirl of a vast population everywhere; many of the farmers and miners have to travel many miles for an occasional glimpse of the theatre or the concert hall. One is not surrounded, as here, by a bewildering variety of artificial attractions. But in all the essentials of a sound life there is no inferiority; indeed, I doubt very much whether it could not be said that for the average man there is a decided superiority.

Education of a high character is universally and freely diffused; libraries exist for the studious; hospitals for the sick; the worker is protected by factory laws and State industrial arbitration; all men and all women enjoy the highest privileges of citizenship; and the charity provision ensures that no one shall starve. Government that has produced this state of civilisation, while at the same time providing water in an apparent wilderness, bringing the railway where only the crow flew, and solving all the practical problems of existence where no man dwelt but a few years ago, has achieved a success that entitles it to respect if not to admiration.

## Problems of the People.

Nor are the people individually left without problems to face and surmount. It is difficult for persons accustomed to conditions which have

developed during a thousand years, who are born into a ready-made civilisation, to realise what it is to go out into the untamed wilderness and erect a state of society—to create *ab initio* all the facilities to which, in a greater or less degree, they and their fathers have been accustomed without a break for many generations.

Take the farmer; he does not rent a farm which has been tilled for hundreds of years, on which buildings have been established for a long period, which has been fenced and hedged in and divided up and planned out almost from time immemorial. He goes on to virgin land, on which he has probably to sink wells and build dams, to erect a house and farm buildings, and must do these things largely himself. Then he has to clear his land of timber, and so gradually create a farm where there was nothing but wilderness before. And so with the prospector and miner, though in a different way. Each of them has to exercise his own ingenuity and resource, and to face a vague future with a definite plan, which he is determined to carry through step by step. And in the great majority of cases the new settler, practically unaided, except in those main and indispensable provisions which the State makes, rapidly succeeds.

There are wide districts in Western Australia where nothing but virgin land covered with salmon gum existed a few years ago, which to-day are dotted with prosperous and comfortable homesteads. And on the goldfields where the early pioneers lived almost entirely in tents, and had no conveniences of life at all, the visitor to-day will find the people gradually surrounding themselves with one comfort after another.

Because past generations have not provided them with houses ready to be occupied, with tanks filled with water, and so on, these men and women do not sit down and repine, or continue to live the primitive existence to which they were compelled when they first settled on the spot.

They have conquered the wilderness, and no one can see these men and women either on the far goldfields or in the remote farming areas, and observe their dauntlessness, their ingenuity and resource in bringing order out of chaos, and creating substance from apparent nothingness, without conceiving an abounding and abiding faith in the future of the British race where they are given scope to fight and conquer. Both in Government and in individual action in these new countries the people are not only animated by the British spirit, undiminished in daring and resourcefulness, but they are helped, too, by the British tradition—a tradition of sound method, of careful finance, of pure politics, and of high social endeavour. I say, despite some of the unwarranted criticisms to which we have been subjected, that these qualities characterise the State administration as well as the individual effort of the Western Australian community, and other British communities like it.

And these qualities, I think, distinguish British communities and British people. But over them all is another characteristic, which I have certainly not observed in the representatives of other nations—and we have many worthy ones amongst us—and that is the characteristic of high practical imagination. British people have no craven fears of being

great. The men from these islands have even to be restrained in their ambition, for, given an opportunity, they will go out into the wilderness and claim a province for an individual estate. You find no other nation like that. And if this characteristic has sometimes to be restrained in the individual, it is invaluable when translated into commercial action. I am only citing Western Australia's recent advance as a humble but typical example of the fact that as a race we are fitted for "enterprises of great pith and moment," for sound and careful government, and for that sphere of wide practical action which demands at once the highest gifts of imagination and of character.

## THE ROCKY MOUNTAINS OF CANADA.[1]

(*With Illustrations.*)

The Rocky Mountains of Canada are the northern part of the mighty range of Cordilleras which stretches from Alaska to Mexico in North America; their length is from 1400 to 1600 miles, and at places they attain a breadth of from fifty to sixty miles. The first white man who saw them was Mackenzie in 1793. They were then sparsely inhabited by various tribes of Indians, who eked out a precarious livelihood by the chase; but in the nineteenth century, trappers, miners, geologists, surveyors and sportsmen pushed their way over a considerable number of the passes and climbed, or measured, several of the peaks. The construction of the Canadian Pacific Railway at the end of last century inevitably effected a great change. For railway purposes alone detailed and extensive surveys had to be made; numerous passes over the mountains were explored and surveyed; the land was opened out in all directions; a strangely mixed population is taking possession of it, and its many and varied resources are being rapidly developed. Horace Greeley's advice, "Young man, go west," applies to Canada as well as to the United States. In this beautifully illustrated book one of the best known and most experienced explorers of the Rockies, the distinguished Professor of Geology in the University of Toronto, is like the householder in the proverb, who brings out of his treasure things new and old. We have here a number of reminiscences of his experiences of mountaineering, beginning so long ago as 1884, when the Canadian Pacific Railway was steadily pushing its way west. At that time the number of those who had distinguished themselves by arduous climbing was comparatively small; indeed, the Professor tells us that climbing among the Rockies began less than three decades ago. Before that, the work of exploration had been carried on mostly by trappers and prospectors, and by officers of the Canadian Survey, who necessarily paid more attention to explor-

[1] *The Canadian Rockies, New and Old Trails.* By A. P. Coleman, Ph.D., F.R.S., Professor of Geology in the University of Toronto. London and Leipsic: T. Fisher Unwin, 1911. Price 12s. 6d. net.

ing and mapping the passes through the mountains than to ascending to their summits. With the opening of the Canadian Pacific Railway the facilities alike for surveying and for climbing were greatly increased. In his first expedition, in 1884, the Professor had as his companion his brother, a rancher, who also accompanied him in several of the other expeditions which are described in this book. They started from a place on the railway near the present town of Laggan, now a favourite point of departure for those who go in for mountaineering in the Selkirks and the Rockies. Apparently in the expedition in 1884 the Professor's object was to make acquaintance with the mountains, and to survey here and there as opportunity suggested. After visiting the beautiful Lake Louise they marched to the Columbia River and thence to the Spillimacheen. From the ridges above it they had splendid views of the ranges and peaks of which they were to see much more in the following years.

Next year, in 1885, the Professor made another expedition to the Selkirks and Columbia River in order to examine the Big Bend Gold Field. On his way there he met a prospector H., of whom he gives us this excellent thumb-nail portrait. "He was a thorough believer in himself and his gold mines, a hearty laugher and talker, and a man of unusual talent in swearing, all of which naturally made him popular." The expedition so far as gold prospecting was concerned was unprofitable. We may quote the author's description of the place, a "strangely interesting study from the geological as well as the human side. Many thousands of feet of the ancient green schists, with their gold-bearing quartz veins, must have been destroyed by frost and glaciers and rivers, the heavy gold settling down among the quartz pebbles and being caught by the 'riffles' where jagged edges of schist rose in the bed of the creeks. The whole was hidden under the heavy growth of British Columbian valleys, until the hordes of miners had harvested the richest of the Californian placers, and in the early sixties began to swarm north-west over Oregon and Washington, overflowing along the Columbia and Fraser valleys into British Columbia. It was a strange army of thousands, recruited from the sturdiest men of all nations, that invaded these peaceful valleys clothed with ancient forests. Now, in the days of railways and steamboats, it is not easy to imagine the hardships of that advance into a hostile wilderness, the toil through cedar swamps and devil's clubs, or over the rocks or snowfields, with heavy packs on the back of man or beast; or the slavish tracking of heavy dug-outs or *bateaux* against stiff currents, with here and there a wild rapid."

In 1888 Prof. Coleman and an adventurous young friend, Frank Stover, who "had never paddled a canoe, nor climbed a mountain, nor shot a grizzly, and earnestly desired to do these things," started off in search of Mount Brown and Mount Hooker, then reported to be the highest peaks in the Rockies, standing, one on each side of the Athabasca Pass. The two explorers canoed down the Columbia River from Beavermouth, having been duly warned to avoid the Surprise Rapids. On the way they were tortured by black flies and hungry mosquitoes, and at times had to proceed by wearisome and dangerous trails, one of

which, a fair example of many, is described thus :—"The trail seemed to vanish altogether for a time, but after half-an-hour's skirmishing we found that it followed some rough-backed logs ; then plunging into a ravine, the trail crossed the creek at the bottom, first on a big fallen spruce, then stepped over to another one swung high over the water, then turned at an angle along a great cottonwood, and ended by balancing on a slender trunk swaying like a spring-board over a bed of devil's clubs lying in wait for any one whose foot slipped. It was a perfectly reckless trail, thrusting its way under close-set alders, and the shades of cedar swamps, where one's foot sank into the muck, hidden by ferns and horsetails and giant skunk cabbage, then out into the glaring sun, along labyrinths of fallen logs in a wind fall. At last it ended on a steep slope down to the river." Ultimately, as Stover was somewhat unwell, and unfit for hard marching, they decided to risk shooting the rapids on a raft, and Professor Coleman describes their experiences thus :—"Presently the current caught us, and we were swept past the point on to the main stream, and I should have given much at that moment to go back, but it was too late. The waves began to drive over our knees, and we paddled desperately to keep clear of a sharp island of rock ahead. From the top of the promontory we had thought the waves were not too much for rafting, but here at the level of the water they seemed mountains high, and we began to wonder if we should get through alive. It was nonsense to paddle any more, for our raft was revolving end for end, and then a great billow fell upon us sideways, and the raft overturned. There was a moment under water, snatched and tugged at by unseen fingers, while I clung to the binding rope, and then I dragged myself upon the upturned bottom of the raft, and saw Frank just scrambling up at the opposite end. I remembered that he could not swim, and shouted to him to hold on for his life—as if he would not do that in any case. We had missed the island, and were now far past it in the very centre of the current, the raft plunging and revolving, while we shifted constantly to face the danger. One pitch followed another, the waves half smothering us from time to time. And now, right ahead, was the worst point of all : what the Ottawa raftsman call a 'collar,' where the water sinks down in front of a ledge of rock, and flings itself backward as a towering wave. A strange sensation of sinking into the depths was followed by a deluge of water leaping and trampling upon us, and then the raft struck heavily, and was nearly dragged from under us. Next moment we were above water again, half strangled, but alive . . . the most violent part of the rapids was over." They continued their toilsome march up the Big Bend Trail for some days, but had to turn back as their stock of provisions had run down. The expedition had failed, but its geographical results were that they had made "acquaintance with the wildest part of one of the most remarkable valleys in North America, the valley that separates the Rocky Mountains from the Selkirks and Gold Ranges. It runs almost straight north-west through the most mountainous region of British Columbia with a length of at least 450 miles. Most great valleys are carved by a river flowing from end to end ; but here is a valley in which

all the main rivers of British Columbia begin their course, no matter where they may end their career." The Kootenay, its tributary the

The Selkirks from Asulkan Pass.

Canoe River, and the Fraser, flow to the Pacific; the Parsnip and Finlay Rivers flow into the Mackenzie River, and thence into the Arctic Ocean. "The famous canyon of the Colorado, 300 miles long and

5000 feet in depth, with a breadth of 10 or 15 miles, is out of the running as compared with the valley of the Upper Columbia at Surprise Rapids, which is more than 8000 feet below the nearer Rockies and Selkirks, the opposite summits standing 15 or 20 miles apart. Probably five times as many cubic miles of rock have been carved from this valley and disposed of as in the Colorado Canyon."

Undeterred, or, more probably, stimulated by his failure to reach Mount Brown in 1888, the Professor renewed his attempt in 1892, and on this occasion he took with him a much stronger party. Canoes were abandoned in favour of cayuses or ponies, with two Stoney Indians as guides towards the Athabasca Pass. Our guide "felt the importance of his position as guide, and was arrayed in his Sunday broadcloth, inherited from the missionary, and befitting the office of sexton." The starting-point was Morley; and the intention was to skirt the range, turn into one of the gaps, and make for Whirlpool River, which heads between Mounts Brown and Hooker. The guides conducted them over wearisome and exhausting trails as before to the Saskatchewan River, thence to the Brazeau River, and thence to the Sanwapta River. There, as no sign of either Mount Brown or Mount Hooker could be seen, they decided to climb Fortress Mountain (9600 feet), from which they discovered Fortress Lake and Misty Mountain (10,050 feet). But time did not permit of their staying longer, and the party had to return. They had failed to find Mount Brown, but they "had covered five hundred miles of unmapped mountain trails, had discovered and named rivers, lakes, and passes, and climbed a dozen virgin mountains. We had shifted materially the boundary between Alberta and British Columbia by proving that the Fortress Lake valley drained into the Columbia River. Hitherto the line had been drawn straight on the maps of the mountains, but henceforth it would bend eight miles to the east of its former position." Next year, 1893, found the Professor, his brother, and Professor Stewart on the same errand, but on this occasion they dispensed with Indian guides, taking, in their place, Sibbald, a rancher, who could speak the Cree and Stoney languages. Their previous experience enabled them to take a shorter route to the Sanwapta River, which they followed to its junction with the Athabasca. Thence they marched to the Whirlpool River, soon after reaching which Professor Coleman was more or less disabled by being thrown from his horse; no bones were broken, but his left knee was badly wrenched, and all hope of his climbing Mount Brown was dissipated. At last the party reached their goal, but only to be badly disappointed. "We looked in vain for magnificent summits rising ten thousand feet above the pass, one on each side. Instead we saw commonplace mountains with nothing distinguished in their appearance, undoubtedly lower than half a dozen peaks we had climbed as incidents along the way for the fun of the thing, or as look-out points from which to choose our route. . . . We had reached our point after six weeks of toil and anxiety, after three summers of effort, and we did not even raise a cheer. Mount Brown and Mount Hooker were frauds, and we were disgusted at having been humbugged by them." Professor Stewart and Mr. Coleman

climbed to the summit of Mount Brown, the height of which was found to be 9365 feet.

Nine years elapsed ere the Professor visited the Rockies again. On the occasion of his expedition to them in 1902, he was accompanied by his wife as well as his brother, and they marched to Brazeau Mountain, which the gentlemen climbed to the height of 10,550 feet, about 500 feet from the summit, but had to turn back again. We quote the Professor's eloquent and instructive description of the view from a mountain top. "How strangely the world has been built, bed after bed of limestone, or slate or quartzite, pale grey or pale green, or dark red or purple, built into cathedrals or castles, or crumpled like coloured clothes from the rag-bag, squeezed together into arches and troughs, into V's and S's and M's ten miles long and two miles high; or else sheets of rock twenty thousand feet thick have been sliced into blocks and tilted up to play leap-frog with one another. And then the sculpturing that is going on! One is right in the midst of the workshop bustle where mountains are being carved into pinnacles, magnificent cathedral doors that never open, towers that never had a keeper—all being shaped before one's eyes out of the mighty beds and blocks of limestone and quartzite that were once the sea bottom. You can watch the tools at work, the chisel and the gouge, the file and the sandpaper. All the workmen are hard at it this spring morning in August; the quarryman, Frost, has been busy over night, as you hear from the thunder of big blocks quarried from the cliff across the valley; there is a dazzling gleam on the moist polished rock which craftsman Glacier has just handed over to the daylight, and you can watch how recklessly the waterfall is cutting its way down, slicing the great banks of rocks with canyons. It is inspiring to visit the mountains any day in the year, but especially so in the July or August spring time, when a fresh start is made, and plants, animals, patient glaciers, bustling torrents, roaring rivers, shining lakes are all hard at work rough-hewing or putting finishing touches on an ever new world."

In the next two sections of the book Professor Coleman describes his abortive attempts to reach the summit of Mount Robson, the highest peak in the Canadian Rockies. In the first attempt, in 1907, the party consisted of the Professor, his brother, and the Reverend Mr. Kinney of Victoria, with Jack Boker as packer. They started from Laggan in the beginning of August and followed the usual trails north to the Saskatchewan, and thence to the watershed between the Saskatchewan and Athabasca, where they met Mrs. Mary Schaeffer on one of the expeditions she has so felicitously described in her *Old Indian Trails*, a notice of which appears in this number of this magazine (p. 108). Continuing north past the Whirlpool River they crossed the Athabasca on a raft, and then turned westward to the Yellowhead Pass and Yellowhead Lake, and thence on to the Fraser River. Along this trail they met advance parties locating the line of the Canadian Pacific Railway. At length, following up the valley of the Grand Fork River, they came in sight of their goal. But too much time had been spent on the road; it was late in the season, and provisions were short: only three days' supplies were

left, so after a climb of about one-third of the way up, the party had reluctantly to acknowledge that the attempt must be abandoned for that year.

Next year again in the beginning of August, the party reassembled at Edmonton, started forth on the same errand, and followed the same route, *i.e.* to the Athabasca and up its valley. Then taking the advice of a half-breed they trailed up one fork of the Moose River, where they crossed over a pass nearly 7000 feet high, the watershed of the continent, and they dropped down to the Smoky River, which they followed to its source at the foot of Mount Robson. Unfortunately the party had again lost much valuable time on the road, and when they reached Mount

Mount Robson from the south-west, at 3000 feet.

Robson they encountered very bad weather which rendered immediate climbing impossible. They were encamped about 5700 feet above the level of the sea, and utilised their enforced leisure by mapping their surroundings, the results of which are both interesting and curious. On the south-west of their camp was a lake which they named Berg Lake, and on the north-west there was another which they named Adolphus Lake after their half-breed guide. The mile between these lakes was the watershed. A large glacier comes down Mount Robson, breaks up into various streams, some of which flow into Berg Lake and some into Adolphus Lake. "The branches feeding Berg Lake make their way to Fraser River and the Pacific at Vancouver, while the other branches flow northwards through Smoky and Peace Rivers to the Mackenzie and Arctic Ocean, so far as I am aware, a unique instance of a river dividing and flowing in opposite directions to separate oceans. A curious

geographical puzzle attaches to this stream leaping from its ice cavern, since the region drained by Smoky River belongs to Alberta, and that by Fraser River to British Columbia, the watershed forming the boundary of the two provinces. What part of the glacier and of the mountain belongs to each province? Until our arrival at Mount Robson from the north side, it had always been supposed that the whole mountain and a large stretch of territory to the north-east belonged to British Columbia, and all the maps indicate the boundary so; but the discovery that Smoky River has its head at Mount Robson transfers hundreds of square miles of mountains from that province to Alberta." But time was running out and provisions were getting short. The first attempt to climb the peak was made on the 5th September, and they reached a height of 10,300 feet, but then had to return to camp. Unpropitious weather again caused further loss of precious time, but Mr. Kinney on the 9th made a courageous though unsuccessful attempt to get to the top alone. A blink of fine weather on the 11th induced them to try once more, but most unfortunately they lost two invaluable hours by getting into an impasse, and after toiling to a height of 11,300 or 11,600 feet they had to acknowledge defeat and retrace their steps. "The return was no child's play. Some glissading but much more ploughing through deep snow brought us to the edge of the ice-ravine, after which most of the descent to the surface of the main glacier meant the most careful choosing of steps, often face to the cliff, holding on with the hands and seeking the old foothold, now half-filled with drifting snow, with the free foot. The rope was kept carefully at the right tension and each of us avoided a false step, for a false step would have swept us all three down a thousand feet to land at last on the avalanche path. Occasionally the frozen drip from above had partly closed a step, when the lowest man had to open it up again with the pick, the re-cutting being much more difficult than the first cutting. It was the most risky bit of ice work any of us had done."

Next year, however, Mr. Kinney and Mr. Phillips achieved the feat on the 13th August and reached the summit, which they found to be a narrow ridge, with a dangerous snow cornice, 13,700 feet above sea-level. In the concluding chapters of his book the Professor discusses with legitimate pride and enthusiasm the many attractions and charms of these mountains which are potent enough to divert mountaineers from the much more lofty peaks of the Alps or the Andes; and he describes in graphic and vigorous language the wondrous process of the building of the mountains. It requires a powerful strain on the imagination to realise that "at the completion of the work, the Rocky Mountains were perhaps as lofty as the Andes or Himalayas, for the tooth of time has been devouring their summits during all the millions of years between the Eocene and the present, so their full stature must have been diminished by thousands of feet."

For many readers one of the most enjoyable parts of the book will be the many beautiful photographic illustrations, two of which by the courtesy of the publishers we are enabled to reproduce.

# INVESTIGATION OF TEMPERATURE DISTRIBUTION IN LOCH EARN.

By E. M. Wedderburn, W.S., F.R.S.E.

*(With Illustrations.)*

In the *Magazine* for December 1910 there appears a description of temperature observations[1] made in the Madüsee, Pomerania, with a view to testing the author's theory of the temperature seiche, and the result of these observations was in complete agreement with theory. At the close of this article reference was made to doubts expressed by Professor E. A. Birge, Wisconsin, U.S.A., as to the proper interpretation of the temperature observations in Loch Ness on which the theory was based, and the suggestion was made that observations in Loch Earn might give results which were quite conclusive one way or the other.

With the assistance of a large grant from the Sir John Jackson Tait Memorial Fund of the University of Edinburgh, and a subsidiary grant from the Moray Fund of the University, the author was able, during the month of August last, to carry out observations on a somewhat ambitious scale.

The object was, by means of temperature observations, to obtain fairly complete information as to all the changes of temperature distribution

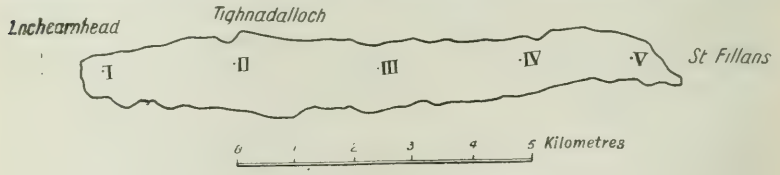



Fig. 1.

which occurred during the period of observation. Arrangements were made for continuous observations at five points in the loch, marked 1, 2, 3, 4 and 5 on the sketch map[2] (Fig. 1). The routine observations at these stations consisted in observations every two hours at eight or nine different depths—at some of the stations, hourly observations were made, at least during the day. At one of the stations the routine observations were carried on without any break, and at the others there were short breaks from unavoidable causes, such as lost instruments, stormy weather, etc.

[1] For a fuller discussion of these observations, see the author's paper on "The Temperature Seiche," *Trans. Roy. Soc. Edin.*, vol. xlvii. p. 612; and also "Gibt es im Madüsee Temperaturseiche?" by Prof. Halbfass, *Intern. Revue der ges. Hydrobiol. und Hydrog.*, Hydrog. Suppl. 1910.

[2] The Bathymetrical map prepared by the Scottish Lake Survey appeared in the *Geog. Jour.*, Sept. 1902.

For the working of each station four observers were allotted: Mr. Herbert Bell, M.A., B.Sc., Edinburgh, was in charge of No. 1: Mr. W. M'Clelland, Edinburgh, of No. 2; Mr. A. J. Ross, M.A., Killin, of No. 3; Mr. W. Watson, M.A., B.Sc., Edinburgh, of No. 4; and Mr. W. Malloch, Perth, of No. 5. The other observers were Messrs. R. K. Butchart, W. Innes, T. G. Ironside, M.A., B.Sc., W. Liddell, W. G. M'Ewan, J. Mackie, M.A., B.Sc., D. MacOwan, M.A., B.Sc., John Marshall, James Mechie, C. W. B. Normand, M.A., B.Sc., V. E. Paske, E. G. Ritchie, G. Shearer, T. M. Steven, J. G. Sutherland, M.A., and A. W. Young.

With so many observers the number of observations made was very large—about 800 temperature readings being made daily. The observa-

The Observers.

tions were tabulated by the observers every day, and curves drawn from them, so that, to a certain extent, the making of the observations and their discussion proceeded simultaneously, and in this way the author was able to keep in touch with the observations carried on at all five stations, but the smoothness with which the work proceeded was due to the disinterested keenness which all displayed. The housing of so large a number of observers was a matter of some difficulty, especially at a time when the district was invaded by summer visitors, but eventually accommodation for the Station 1 observers was found at Lochview, Lochearnhead; for the Stations 2 and 3 observers at Tighnadalloch Farm; and for the Stations 4 and 5 observers at Neish, St. Fillans. Most of the observers therefore had to live at some distance from their station, which made the work more tedious than it would otherwise have been.

All gave their services gratuitously and made little of the difficulties which they overcame, or of the comfortless nature of the work. To those in charge of the various stations especially was the success of the expedition due.

Each station was equipped with two boats, and in all a fleet of eleven boats was in use. Most of these were brought from Perth, as it was not found possible to hire a sufficient number locally. At each station a boat was anchored by a 2″ circ. Manilla rope and a 50 lb. anchor. This was found sufficient, though at one of the stations the boat dragged its anchor during a storm, towards the close of the observations. Communication between the anchored boat and the shore was made by means of a second boat.

Each station was supplied with a Negretti and Zambra deep-sea reversing thermometer, and, on the whole, these were found to work satisfactorily. The reversing frames were partly of the Scottish pattern, and partly of the Parson's pattern introduced by the Lake Survey, the latter being the more popular with the observers. Messengers of the Macdonald type were used and found to work satisfactorily.

For lowering the thermometer there was used a flexible steel wire rope $\frac{3}{16}$″ circumference, and this was found to answer admirably. Two thermometers were lost by the wire breaking just above the point of attachment to the thermometer, owing to the chafing action of the messenger, but when the tendency to break was discovered further accidents were avoided by careful examination of the wire from time to time and the removal of frayed portions. The wires were marked at intervals of a metre by small lead discs sweated on to the wire, each bearing an appropriate number. This was of the nature of an experiment, but was found to answer well. The cost of gear to measure the wire as it ran out was thus avoided, and simplicity of working was obtained.

Strong zinc drums were used for winding the thermometers up and down. These were clamped at the end of a five-foot plank which was fastened athwart the boat, with the drum projecting over the side. The plank formed a seat for the observer, and the whole arrangement was found very convenient. Previous experience had shown that existing types of sounding-machines were not very suitable for temperature observations, and the success of the methods which were adopted was gratifying.

In addition to the observations of lake temperature numerous meteorological observations were made. At each station a record of air temperature was kept by means of sling thermometers, also notes on wind and clouds. At Lochearnhead, Tighnadalloch and St. Fillans thermographs and rain gauges were installed, and at Tighnadalloch there were in addition a Stokes sunshine recorder and a Dines anemograph.[1]

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[1] The author is indebted to various gentlemen and institutions for the use of instruments —to Sir John Murray for reversing thermometers and current meter, to the director of the meteorological office for thermographs, sunshine recorder and parts of the anemograph, to Professor Niven, Aberdeen, for the anemograph, to the Scottish Meteorological Society for rain-gauges and thermometer screens. Dr. W. S. Bruce also kindly offered me the use of a reversing thermometer.

Loch Earn was chosen for the purpose of these observations principally because the ordinary seiches in the loch had already been carefully investigated by the late Professor Chrystal,[1] and it was in this loch that he brought to the test his hydrodynamical theories and used the recording instruments which he designed. The loch was found to be "well tuned" for the ordinary seiche, and as its basin is quite simple in shape their investigation was comparatively simple, and it was hoped that the

Reading a thermometer.

investigation of the temperature seiche would be equally simple. The loch runs almost due east and west and has a length of about 6½ miles. Therefore the five stations were at distances of about 1½ miles from each other. At Station No. 1 the depth was about 35 metres, at No. 2 65 metres, at No. 3 80 metres, at No. 4 65 metres, and at No. 5 30 metres.

The temperature seiche, according to our theory, occurs when there

[1] Professor Chrystal's data and calculations for Loch Earn have kindly been made available to me by his family, and I have thus been saved the repetition of a good deal of tedious work, which was undertaken for our joint paper on the "Calculation of the Periods and Nodes of Lochs Earn and Treig." See *Trans. Roy. Soc. Edin.*, vol. xli. p. 823.

is a sudden discontinuity of the temperature gradient at some distance below the surface—or in other words, when there is a layer in the loch in which the change of temperature is very rapid. Happily such a temperature distribution was obtained shortly after the observations were commenced on 4th August 1911. This will be better understood from Fig. 2, which gives the temperature distribution at each station as shown from the 4-5 A.M. observations on 7th August. Thus there is

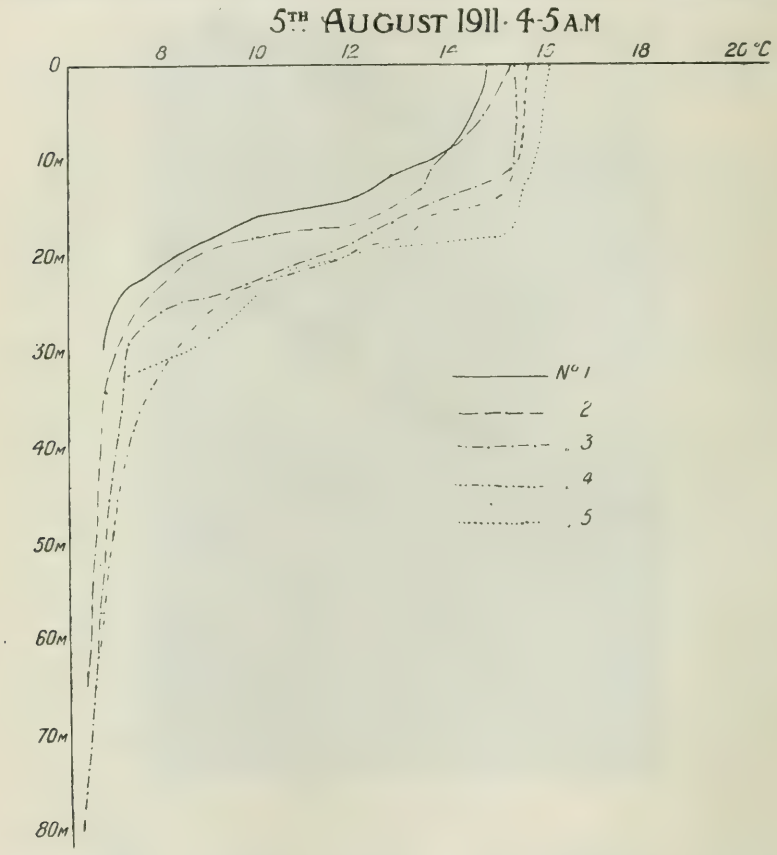


FIG. 2.

seen to be at the surface a layer of say 15 metres through which the fall of temperature is comparatively slow, and thereafter a rapid fall succeeded by a very gradual fall. The distribution was not always so simple as is shown in the diagram, but it was of the same general type during the first half of the month. If we now proceed to calculate what the period of the temperature seiche ought to be according to theory, we may assume, for a rough calculation, that the period would be the same if for a depth of 15 metres the water had a uniform temperature of 15° C., and then fell suddenly to 7° (a sudden drop of 8°) which is

assumed to be the temperature of all the remaining water. The second method of approximating to the period given in the author's paper on the Madüsee observations makes use of the following formula, where T is the period of the temperature seiche and $t$ that of the ordinary seiche :

$$T = t.\frac{\text{area of surface of separation}}{\text{area of free surface}}\sqrt{\frac{\text{h of seiche normal curve}}{\text{h of temp. normal curve} \times (\rho - \rho')}}$$

$\rho$ is the density of the lower layer of water, and $\rho'$ the density of the upper. The ratio $\frac{\text{h of seiche normal curve}}{\text{h of temp. normal curve}}$ can be obtained with sufficient accuracy by examining a cross section at the deepest part of the lake. The period of the ordinary seiche in Loch Earn is known to be about 14·5 minutes, and by means of the above formula we can without much difficulty arrive at a rough approximation for the period of the temperature seiche, viz. 16 hours.

The fact that it is possible to arrive at an approximation of the period of the temperature seiche from the period of the ordinary seiche is a very striking one. Of course the approximation is only a rough one in most cases and would only be accurate in the case of lochs with a symmetric parabolic normal curve.

It is not possible to explain the meaning of "normal curve" without using mathematical expressions, but for our purposes here it may be sufficient to explain that it is a curve which takes into account all the variations of breadth and depth in a loch. Upon the simplicity of these curves depends the ease with which the period of the seiche can be approximated to.

When observations were commenced a temperature seiche was in progress, as will be seen from Fig. 3. This diagram shows for each of the five stations the depth at which a temperature of 12° C. was found from hour to hour, and at each station, except No. 3, there is a well-marked period of 15 hours. That this period is due to the temperature seiche is clearly shown from the fact that no oscillation of that period is observable at Station 3, at which point, therefore, there is a node. Moreover, the phase of the oscillations at Stations 1 and 2 is practically the same, but is directly opposite to the phase at Stations 4 and 5. The oscillations in temperature must therefore be due to a standing oscillation. Had they been due to a travelling wave, instead of coincidence of phase at Stations 1 and 2, and the opposition of phase on either side of the centre, we would have found a gradual change of phase from one end of the loch to the other.

If the curve for Station 3 is examined it is possible to make out an oscillation with a period of about 8 hours, which is probably due to a binodal seiche. It is a curious coincidence that the periods of the uninodal and binodal seiche were found by Professor Chrystal to be 14·5 and 8·1 minutes respectively, while our observations show that the periods of the temperature seiche (uninodal and binodal) in the beginning of August were 15 and 8 hours respectively. It is no coincidence that the ratio between the uninodal and binodal periods is practically the same in both cases. The period for the temperature seiche which

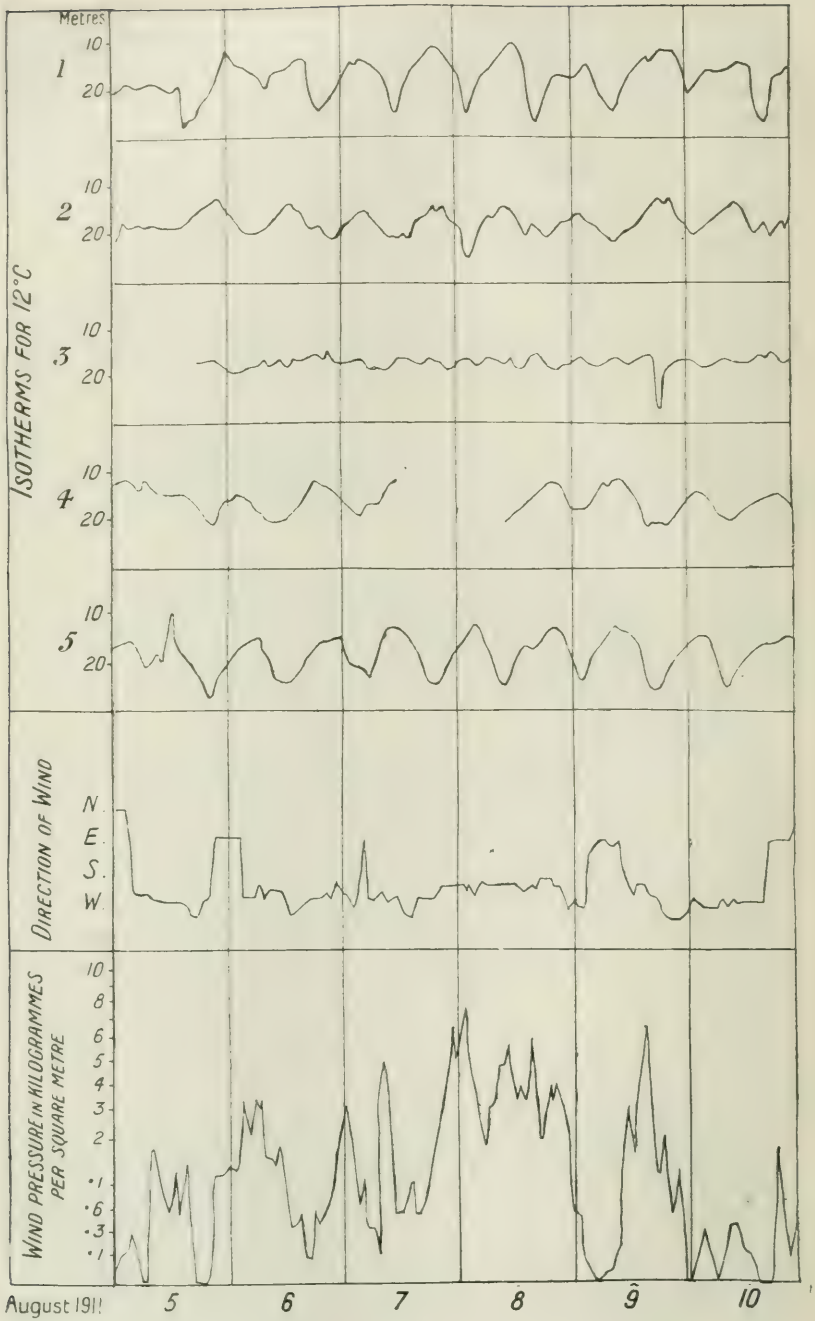
Metres
1
2
3
4
5
10
20
ISOTHERMS FOR 12°C
DIRECTION OF WIND
N.
E.
S.
W.
WIND PRESSURE IN KILOGRAMMES PER SQUARE METRE
10
8
6
5
4
3
2
·1
·6
·3
·1
August 1911
5
6
7
8
9
10

FIG. 3.

our calculation gave was 16 hours, which is, considering the roughness of our approximation, as close agreement as could be expected.

Professor Birge suggested that variations in the direction and pressure of the wind might account for the variations of lake temperatures observed, and with a view to testing this suggestion, there have been added at the foot of Fig. 3 two curves, the upper of which shows variations in the direction of the wind and the lower variations in wind pressure. This lower curve was drawn from the data supplied by the anemograph at Tighnadalloch. Little or no connection can be traced between the variations in the wind and the oscillations in the loch—doubtless many of the irregularities of the oscillation are due to wind variations, but it can be confidently stated that each separate oscillation

Loch Earn, looking east.

was not separately caused by variations in the direction or strength of the wind.

On 10th August, about 6 P.M., the oscillations suddenly stopped. During the previous part of the day the weather had been calm, with light westerly winds, but about 6 P.M. a fairly strong east wind rose, and by 7 o'clock on the following morning it was again quite calm. Had there not been this sudden change of wind the discontinuity layer would probably have been rising at the west end of the loch from 6 P.M. until about 3 A.M. on the 11th, and thereafter have fallen. But the effect of an east wind is to depress the discontinuity at the west end, and in this case the oscillation appears to have been damped off altogether. Had this not been so there are indications that a large seiche was just starting as a result of the strong winds experienced on the 9th and previous days. On reference to Fig. 3 it is seen that a strong west wind arose suddenly about 11 A.M. on the 9th, but as the discontinuity was rising

at the west end at that time, the oscillation was increased rather than diminished.

Unfortunately for our observations the temperature seiche having been killed on 10th August, no other seiche commenced to take its place. At first this was considered damaging to our theory, and it was certainly a disappointment to the observers; for there is some excitement in observing a rapidly varying temperature, even at the dead of a very wet night, but when the thermometer readings vary very little from one another, it is hard to keep up interest under trying weather conditions.

But, instead of damaging our theory, this lack of a temperature seiche really confirms it. From 8th August onwards there was a succession of very sunny days which had the effect of rapidly heating up the surface of the loch. The following table gives the amount of sunshine from day to day as shown by the sunshine recorder at Tighnadalloch, and also the surface temperature of the loch at Station No. 3 at midnight:—

| August. | Hours of Sunshine. | Surface Temperature Station 3. | August. | Hours of Sunshine. | Surface Temperature Station 3. |
|---|---|---|---|---|---|
| 4 | $2\frac{1}{2}$ | ... | 15 | $11\frac{1}{2}$ | 17·4 |
| 5 | 2 | 15·6 | 16 | 6 | 17·0 |
| 6 | $2\frac{1}{2}$ | 15·4 | 17 | $5\frac{1}{4}$ | 17·1 |
| 7 | 2 | 15·3 | 18 | $5\frac{1}{4}$ | 17·5 |
| 8 | 8 | 15·5 | 19 | 0 | 17·1 |
| 9 | $12\frac{1}{4}$ | 16·0 | 20 | 2 | 17·2 |
| 10 | 13 | 16·2 | 21 | $4\frac{1}{4}$ | 17·4 |
| 11 | $12\frac{3}{4}$ | 16·5 | 22 | $3\frac{3}{4}$ | 17·0 |
| 12 | $2\frac{3}{4}$ | 16·2 | 23 | $4\frac{1}{2}$ | 16·9 |
| 13 | $9\frac{1}{4}$ | 16·4 | 24 | 0 | 16·4 |
| 14 | $\frac{3}{4}$ | 16·3 | 25 | $2\frac{1}{4}$ | 16·0 |

The effect of the long sunshine is very quickly seen on the surface temperature, and a skin of warm water formed over the loch which effectually prevented a temperature seiche of any considerable amplitude being started. Elsewhere attention has been drawn to the fact that so long as there is a rapid fall of temperature at the surface there can be no temperature seiche. For a thin layer of high temperature at the surface forms a skin which prevents wind-produced currents penetrating to any depth. The currents all take place at or near the surface. Of course the skin will gradually be broken down if there is a succession of cold sunless days with strong winds, and an isothermal layer of considerable depth will form at the surface. But we had not this type of weather in August until the end of the month when observations were being discontinued, and, therefore, there were no well-marked temperature seiches. Towards the end of the month there were indications of the commencement of a seiche.

Fig. 4 shows the temperature distribution at Lochearnhead from 10th to 26th August. Each curve is an isothermal for a definite temperature,

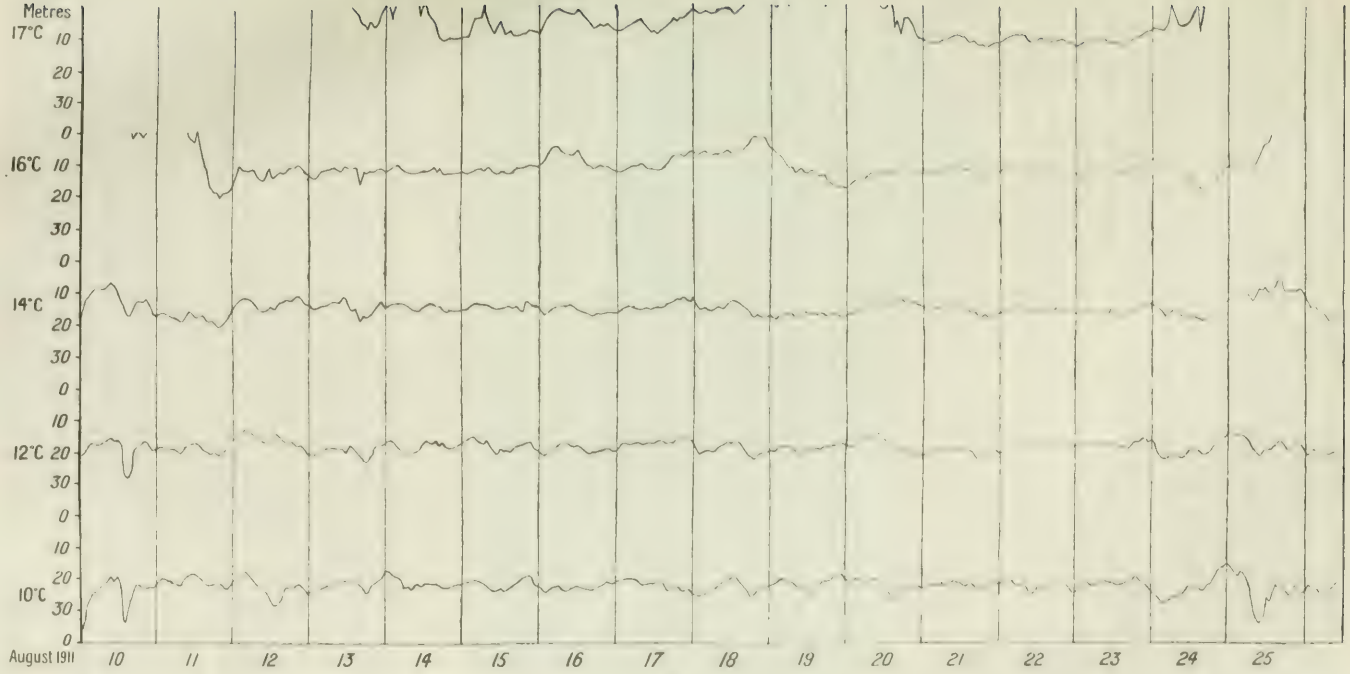
Metres
17°C
10
20
30
0
16°C
10
20
30
0
14°C
10
20
30
0
10
12°C
20
30
0
10
20
10°C
30
0
August 1911
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

FIG. 4.

which is indicated in the margin. The vertical scale indicates the depth at which a definite temperature occurs, and the horizontal scale measures time. The 16° C. isothermal begins on 10th, indicating that then, for the first time, was a temperature of 16° C. observed at Station 1. Similarly the 17° isotherm commences on the 13th, showing the rapidity with which the surface of the loch was being heated up. The disappearance of the 17° curve on the 24th and the 16° curve on the 25th indicates the cooling of the surface during the stormy weather at the end of the month. The variations in the 16° and 17° curves can mostly be traced to changes in wind pressure or direction. As we are considering observations at the west end of the loch, it will be necessary to bear in mind that the tendency of a west wind is to drive warm surface water away from the west end, and, therefore, to raise the surface isotherms, while in the case of an east wind the tendency is to lower the isotherms at the west end. Thus, on the 11th, a strong east wind accounts for the rapid fall in the 16° isotherm, without any corresponding fall in the lower isotherms; and yet when the wind moderated about 8 P.M. all the isotherms from top to bottom rise slightly, and, in fact, a slight oscillation is started which can be traced until the 16th in the 10°, 12°, and 14° isotherms, the period being again about fifteen hours. During this time the winds were all easterly, of varying strength. On the 17th the wind changed to the west, and a gradual rise is seen in the 16° and 17° isotherms. The westerly winds were not, however, of considerable strength. About midnight, between 17th and 18th, they fell to a calm, and at this time a small temperature seiche again starts, being most easily seen in the 10° curve, and this oscillation can be traced until the 20th. At midnight, between the 18th and 19th, the wind again changed to the east, and the effect is at once seen on the upper isotherm, and not at all on the lowest. The effect of a calm on the afternoon of the 19th is shown in a rise of the 16° and 14° curves to their normal level. At noon, on the 23rd, the wind changed to a westerly direction, but it did not attain much strength until the 24th. At midnight, on the 24th, the wind was higher than at any time during the observations, and its effect can be seen on each of the curves. The upper ones disappear, but the 10° and 12°, particularly the former, sink downwards, which is in agreement with observations in other lakes, and will be explained when we come to deal with currents. It is a pity that the observations had to be stopped so soon just when the weather conditions were such as to make interesting results certain, but it was unavoidable. The observations at Station 5 were continued until the 28th, and they show the beginning of oscillations of moderate amplitude, but slightly irregular.

It now only remains to deal with the current observations which were made. Two Ekman current meters [1] were at our disposal, and these were put in charge of Mr. Ritchie. Each had to be lowered from a separate drum, so the boat in which temperature and current observa-

[1] The method of working these meters is described in *Proc. Roy. Soc. Edin.*, vol. xxix. p. 619.

tions proceeded simultaneously was fully loaded. The boat in which Mr. Ritchie was working was anchored fore and aft so as to make it as stationary as possible. The author's theory as to lake currents (while there is a temperature discontinuity) was briefly as follows. Unless during very high winds, direct wind-produced currents do not penetrate below the temperature discontinuity. A current is caused at the surface in the direction of the wind, and a return current is formed below the surface to replace the water which moves along at the surface. The depth at which this return current is found depends on the temperature gradient at the surface. If there is a high surface temperature with a considerable fall in temperature immediately below, then the return current will be found near the surface because of the low density of the

Station 1 with two drums at stern for current meters.

warm surface water. But gradually this return current mixes up all the water about the discontinuity, and unless there is a large amount of heating going on at the surface, it sinks until it reaches the discontinuity. It was also thought that below the discontinuity there was a secondary return current in the same direction as the wind, but only when the return current was taking place along the discontinuity. Experiment seemed to show that this was so, and the fan-like arrangement of isotherms found in lakes seemed to indicate it as likely. The isotherms are nearly always bunched together at the lee end of the lake, and radiate fan-like from that end, the upper isotherms sloping upwards and the lower ones downwards, just as on 25th August. In Loch Earn the 10° isotherm is seen to fall at the west end of the loch with a west wind. But direct confirmation of this secondary return current, which is necessarily very slow, has hitherto been very hard to obtain.

The current meters used were not supposed to be accurate for currents

of less than 3 cm. per sec., but, except at the surface, it was rare to find currents of this velocity recorded. For the purposes of this paper it will be sufficient to confine attention to currents which were registered as of more than 2 cm. per sec. Though the instruments may not have recorded the velocity of these currents accurately, they were sensitive to very small changes of direction, and probably the directions indicated may be relied on. Unfortunately systematic observations with the current meters were not commenced until 11th August, as up to that date attention was confined to the temperature observations.

Observations were made at Station 1 from the 11th to the 14th. Apart from the surface observations there were only four occasions on which currents of greater velocity than 2 cm. per sec. were observed, and three of these were on the same day—viz. 12th August. On the other occasion the velocity was only greater than 2 cm. per sec. by a very small amount. It will be remembered that a small temperature seiche was started on 12th August on the cessation of a strong east wind of short duration, so the current meters probably show the flowing back to normal levels of water layers displaced by the wind. The currents at the surface were from the east, as a light east wind was still prevailing, but at a depth of about 15 metres, *i.e.* near the discontinuity, there were well-marked westerly currents. Then again at 25 metres there is a well-marked current, but from the east, while at 30 metres the current is well marked, but from N.W. The following table gives the observations on this day :—

| Depth in fathoms. | Direction. | Velocity cms. per sec. |
|---|---|---|
| Surface | N. 50° E. | 2·1 |
| 2 | ... | ·9 |
| 3 | N. 10° E. | ·7 |
| 4 | N. 110° W. | 1·3 |
| 5 | N. 89° W. | 2·3 |
| 6 | N. 75° W. | 1·8 |
| 7 | N. 105° W. | ·9 |
| 8 | N. 30° W. | 1·6 |
| 9 | ... | ·6 |
| 10 | N. 112° E. | 2·1 |
| 12 | N. 45° W. | 2·8 |
| 14 | N. 170° W. | 1·2 |
| 15 | ... | ·7 |

The occurrence of an easterly current at 10 fathoms (about 25 metres) is hard to understand, and must have been due to some local cause.

Observations were made at Station 3 from 15th to 20th August, and the currents observed there were much stronger. The observations on the 18th were the most interesting, and on this day a strong west wind got up during the day, and a temperature seiche of small amplitude was also observed. At the surface there was a westerly current of 12 cm. per sec., while at 18 metres there was an easterly current of 7·8 cm.

per sec., and again at 27 metres a westerly current of about 4 cm. per sec. The currents were still appreciable at greater depths, and seemed to veer round again to east through S., for at 27 metres the direction recorded is S. 20° W. and at 30 metres S. 40° E. These observations give a good example of a current below the discontinuity in the same direction as the surface current, and observations on other days show the same thing.

At Station 5 observations were made from 22nd to 27th August, but, except on the 25th, a day of strong west winds, little was obtained. On that day the strongest currents observed (only 4·5 cm. per sec.) were at a depth of 14 metres, and were in an easterly direction. The currents observed at other depths were almost too feeble for any importance to be attached to them.

As a whole the results of the current observations do not add much to our knowledge, for the conditions were most unsuitable. Even the highest velocity recorded, 12 cm. per sec., is very slow, and the greatest velocity below the surface was 8 cm. per sec., less than ¼ of a mile per hour, and this must be attributable to the skin of warm water on the surface. As might have been, and indeed was, expected the currents were more marked in the centre of the loch than at the ends. The observations, however, also indicate that apart from the fact that a surface skin of warm water prevents the formation of strong currents, it directly damps the temperature seiche, otherwise a larger oscillation would have commenced both on the 12th and 18th August, which is in accordance with views formed by the author from theoretical and experimental considerations.

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**Correspondence: A New Graphic Map.**—Mr. D. Pryde writes:—

"Under the above heading there appears in the January number of the Society's *Magazine* a description of what is claimed to be a new map. But merely to alter the name of a projection does not constitute originality, and the projection described by Mr. Strachan is one which is well known to map-makers as Sanson-Flamsteed's. It is constantly used for countries, such as South America, having great extent in latitude, but is unsuited to maps of the whole world. That it could be used for such maps all students of the subject know, and the most recent book on map-projections even gives such a network as frontispiece: the author, Mr. Craig, however, is careful in the text to state its unsuitability for world maps.

"While the projection itself may be old some of the claims put forth for it by Mr. Strachan are, no doubt, new. He says that on it 'distances . . . can be accurately measured.' The absurdity of this claim is seen when one remembers that the distance from pole to pole along each meridian is the same. That true distances between any two points may be calculated is not disputed, that, however, is another matter. Angles, too, are wrong, for is not the bounding line of the map a North and South line just as the central meridian is? It is surely evident to all, that if the meridian cuts the parallel at any angle other than 90 degrees, directions must be wrong to the extent of this variation, and because of this, the

scale must also be variable. The use of the combined scale and cross-scale does not change that; the combination indeed seems to be but a generalised application of the principles of middle latitude sailing. I am afraid the author has but a vague idea of the different sailings and of the meaning of a ship's-course.

"In concluding, might I be permitted to take an example from the map itself? On it a latitudinal scale is shown stretching from 120 degrees W. on the Equator, and reaching 190 degrees W. (or 170 degrees E.) on 50 degrees N., and the distance between these two points is given as 3452·5 miles. Now, while it is true that that represents the distance on the central meridian, it does not give the distance between the two points noted. Again, this scale is carried southwards to the same point in the southern hemisphere. With the central part of this line lying so much to the east, and yet the whole shown as a straight line, one can only ask how such a distorted course can be of much service to the navigator."

EDINBURGH, *Jan.* 1912.

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## PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

### MEETINGS IN FEBRUARY.

ON the 6th, in Edinburgh, Sir Percy Cunynghame, Bart., will deliver a lecture on "Sarawak." This lecture will be repeated in Aberdeen, Dundee, and Glasgow, on the 7th, 8th, and 9th respectively.

Mr. H. M. Cadell, B.Sc., F.R.S.E. F.S.A. Scot., will lecture before the Aberdeen and Dundee Centres on the 20th and 21st inst. The subject of his address will be "The Story of the Forth."

On the 22nd inst., The Right Hon. Sir George Houston Reid, K.C.M.G., P.C., D.C.L., K.C. (High Commissioner for the Commonwealth of Australia), will deliver an address before the Edinburgh Centre. The subject of his lecture is "The Two Geographies: that of the World of Matter and that of the World of Mind." He will repeat this lecture before the Glasgow Centre the following evening.

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## OBITUARY.

WE regret to record that Mr. I. JULIUS WEINBERG, formerly Chairman of the Society's Branch at Dundee, died at the beginning of the year in the south of England, at an advanced age. Mr. Weinberg, who held a very important position in the business world, was one of the first members of the Society in Dundee, was a member of the local committee from the foundation of the Branch, and became chairman in 1896, a position he held until failing health compelled him to retire some eighteen months ago. He did much to popularise the work of the Society in Dundee, and was a generous supporter of its various schemes.

We regret also to have to record the death of M. ARTHUR DE CLAPARÈDE, docteur en droit, whose name recalls the Ninth Geographical Congress at Geneva, of which he was President. The grace and elegance of the presidential addresses which he delivered there impressed all who heard them.

Dr. Claparède died on December 13, before the completion of his sixtieth year, and we take the following facts in regard to him from a little memorial pamphlet sent to us by Professor Lucien Gautier, of Geneva. His early years were devoted to diplomatic and political work, but his always frail health compelled him to retire at the very early age of thirty-two, and from 1883 until his death he lived at Geneva, devoting much time to the study of geographical problems. He took great interest in the Geographical Society of Geneva, of which he was president during many separate terms, and did much work in connection with *Le Globe*, the organ of the Society, which was largely edited by him. He visited the Eighth International Geographical Congress, held in the United States, as the official delegate of the Swiss Government, and bore the invitation, which was accepted, asking the next Congress to meet in Geneva. The success of that Congress was largely due to his unremitting labours, and he also did not spare himself in connection with the issue of its Proceedings, which have appeared recently in three large volumes, and were edited by him. In addition he wrote several books on the results of his travels, the best known being *Corfou et les Corfiotes*, as well as many papers. He was also a *privat-docent* in political, social and economic geography at the University of Geneva.

## GEOGRAPHICAL NOTES.

### EUROPE.

**Depopulation of Rural Districts in Germany.**—A note in *La Géographie* for July 15 gives some interesting facts in regard to rural depopulation in Germany, which is following, though more slowly, the same course as in the British Isles. In the first place, since 1830 the proportion of persons engaged in agriculture has been steadily diminishing. In that year four-fifths of the total population were engaged in agriculture. By 1860 the proportion was reduced to three-fifths, and by 1895 it had fallen to 35·7 per cent. During the last twenty years German emigration to foreign lands has fallen greatly, but the exodus from the country to the towns increases. In Germany, as in other countries, the intensity of the rural depopulation depends upon the size of the farms, or rather upon the scale upon which they are worked. Large farms mean few hands. In Spain and Italy, where the industries are little developed, the surplus rural population emigrates, in Germany and elsewhere it flocks to the towns.

From the regions where large farms predominate extensive emigration takes place, directed especially to the industrial region of the lower Rhine and Westphalia, to the district of Saarbrücken, the rich region between the Main and the Taunus, the regions round Berlin and

Hanover, those round the mouths of the Elbe and the Weser, the coal-field of Silesia, Lorraine, and so forth. It is the large towns especially which attract, and now some 21 per cent. of the whole population, or about 13,700,000 people, live in towns having more than 100,000 inhabitants.

The explanation seems to be that large farms "depopulate" by reducing the amount of labour necessary. It is calculated that farms of from 15 to 50 acres in extent employ on an average forty-four persons; when the farm increases from 50 to 250 acres the average number of hands sinks to twenty-two, while on those exceeding 250 acres the average is only seventeen persons per farm. In all cases the persons engaged in the management are included. This is not because more produce can be obtained with less labour on the large holdings, for association enables the small holders to obtain all modern advantages, such as manures, machines, co-operative sales and so forth; it is that the large estates usually produce less, and are not so successful economically as the small ones.

To some extent the fertility of the soil affects the matter, most depopulation taking place in the less fertile regions. It is noticeable, however, that the conversion of large estates into industrial concerns, for the production of, *e.g.* beetroot, does not arrest the process of depopulation. On the contrary, such concerns, which only require labour at certain seasons, tend to encourage migratory as contrasted with fixed labour. The original agricultural population departs for the towns, and their place is taken at certain seasons by migratory Poles, etc. So far the only remedy seriously recommended in Germany is the breaking-up of large estates—the formation of small holdings.

## Africa.

**Agricultural and Forest Products of British West Africa.**—Under this title Mr. Gerald C. Dudgeon contributes an interesting volume to the Imperial Institute Series of *Handbooks to the Commercial Resources of the Tropics*, edited by Prof. Wyndham Dunstan. The book, which is furnished with maps and illustrations, and is very well got up, gives accounts of the occurrence, cultivation, and uses of the different tropical products yielded by the Gambia, Sierra Leone, the Gold Coast with Ashanti and the Northern Territories, and Northern and Southern Nigeria. Much detail is given which is not easily found elsewhere, the notes on native methods of agriculture being of special geographical interest.

It is well known that the African negro has never learnt to use cattle or horses for ploughing, except when taught by other races, and as a general rule his methods of cultivation are wasteful and impermanent. In none of the Colonies or Protectorates named are draught animals employed, though in the Gambia efforts are being made to teach their use in agricultural schools. Cattle and horses are easily reared here, but it is stated that the native prejudice against draught animals is very difficult to overcome.

In regard to methods of cultivation the inhabitants of this part of Africa can be arranged in a series. In the Gold Coast and adjacent regions the forest is largely depended upon for food, and cultivation is carried on upon a small scale only. The land is roughly cleared, the surface slightly loosened, and small crops of maize and yams and cassava are obtained for a year or two, after which the ground is allowed to revert to bush. Where cocoa is being planted the land becomes too valuable for this, and some tribes are beginning to resort to deeper cultivation.

In Sierra Leone the land is again only cultivated to a slight degree, the stumps and roots of the bush plants being left in the ground when it is cleared. But this is done with definite purpose, for in this way the land rapidly reverts to bush after two or three years of cultivation, and when, after ten or fifteen years, the bush is again cut down and burnt, an abundant supply of wood ashes is obtained as manure. Seeds are sown broadcast, those of the different plants being mixed together. Rice is the chief plant grown, also maize, yams, sweet potatoes, and cassava, but no leguminous crop.

In the Gambia the land is carefully but not deeply cultivated, a form of rotation is observed, and the alternation of ground-nuts, which are leguminous plants, with the staple food-crops of Guinea corn, maize, millet, and cassava, helps to preserve the fertility of the soil. A rather curious form of farming, presenting certain analogies to the French system of métayage, obtains here. Itinerant farmers from neighbouring regions enter the country every year, and receive a piece of uncleared land, with ground-nut seed and food. The immigrant clears the land, and plants a crop of ground-nuts. He also gives certain services on the owner's land. At the end of the season part of the crop goes to the owner in payment for the seed and food supplied, and the ground is left in good condition for subsequent cropping.

In Southern Nigeria the Yorubas are fairly skilful cultivators, though they do not manure their land, and do not practise irrigation. In consequence of the absence of manuring the land has to be allowed to revert to bush at the end of a few years, and must be left for many years before it can be used again. But the Yorubas practise deep cultivation, and this partly compensates for the lack of manure. With the improvement of farming methods here it is noticeable that the number of plants grown increases—thus the Yorubas cultivate cotton, maize, cassava, yams, sweet potatoes, ground-nuts, Guinea corn, sugar-cane, tobacco, rice, egg-plants, native beans, etc.

The highest stage is reached by the Haussas of Northern Nigeria, who practise irrigation and manure their land carefully. As usual, however, among negroes, the plough is not used, and the shallow cultivation means that heavy manuring is necessary. Many crops are grown, notably Guinea corn, maize, cotton, ground-nuts, millet, wheat, rice, artichokes, etc. Cultivation is continuous, and has been for a long period, at least round Kano; but the yield is small, and the crops suffer severely when the rainfall is scanty, owing to the wasteful methods. The crops fall into three groups—those dependent upon rainfall, the

irrigated crops, and those grown on swamp lands. Upon the first-named the people are chiefly dependent for food, and an inadequate rainy season often produces famine conditions.

Details of the various crops are given in the book, but geographically the most interesting point is the indication of the evolution of agricultural methods as outlined above.

## Commercial Geography.

**Means of Communication in Central America.**—M. de Perigny contributed to the *Annales de Géographie* an interesting article on this subject, illustrated by a sketch-map.

In Costa Rica the recent opening of the line between San José and Punta Arenas has at last given that country a complete interoceanic railway. This line has had a somewhat chequered history. So long ago as 1871 a line between the port of Limon and Alajuela was contracted for, but even this portion of the interoceanic route was not completed till thirteen years later, in 1884. The great development of the banana industry has led to further developments, mostly with American capital. At present the whole railway system only extends to 150 miles, which is quite insufficient for the development of the country, for the paths are during long periods impracticable on account of the rains.

At present four-fifths of the commerce of Costa Rica is carried on through the port of Limon, which has some five thousand inhabitants and two good quays. It is the banana trade which has been especially responsible for its development, which only dates from 1871, when the first house was built. The first shipment of bananas took place in 1880, and consisted of three hundred and sixty bunches. In 1905 more than 7,000,000 bunches were exported, and now it is calculated that the United States take more than 10,000,000 annually, and Great Britain 1,000,000.

In the first instance the bananas were planted merely to give shade to the coffee trees, and it is only recently that they have become an independent crop. The plantations demand much capital, both on account of the difficulties of communication and because of labour difficulties. The region is unhealthy, and negro labour has to be imported from Jamaica, as the negroes are the only workers who can tolerate the climatic conditions.

In Guatemala an interoceanic line was opened in 1908, and the traffic on the Pacific side was at first most important. The first portion of the line to be built was that which connects the port of San Jose de Guatemala with the capital. From this line a branch connects with the port of Champerico, which, like San José and Ocos, is an outlet for the coffee plantations. Ocos has merely a local line, not connected with the transcontinental route. This line, however, is to connect ultimately with the Panamerican line at the point where it emerges from Mexico. The construction of the line from Guatemala to the Atlantic coast presented considerable difficulties, both physical and economic. It was ultimately

accomplished by means of American capital, and it is again the banana trade which has been an important factor in determining its construction. Now the banana boats from Limon to New Orleans stop at Puerto Barrios, the eastern terminus of the line. There is also a considerable export of coffee from this port, almost all of which goes to Hamburg.

Apart from the railway system, means of communication are poorly developed. There are some diligence roads, but these are so badly kept that pack and riding animals are preferred as means of transport. Local trade from town to town is carried on by human porters, the Indians travelling 18 to 20 miles per day and carrying a weight of over 100 lbs. on their backs.

San Salvador has a very badly developed railway system, but it has excellent carriage roads by means of which the coffee and sugar produced are conveyed to the Pacific ports. A concession has also been obtained for the construction of a line from the port of La Union to join the Guatemala system. This would ultimately form a part of the Panamerican line.

Honduras has as yet no interoceanic line, though one was planned so long ago as the middle of last century, which was to extend from Puerto Cortez on the Atlantic to San Lorenzo on the Pacific. The Pacific sea-board is small, and has only one port, Ampala, connected by a very fine road to Tegucigalpa, the capital. All transport is carried on in waggons with solid wheels, drawn by oxen or teams of mules. A few years ago an efficient service of motor waggons was in existence between the capital and the Pacific coast, but with a change of government this was stopped and the road has to a considerable extent fallen out of repair. On the Atlantic seaboard there are many seaports, *e.g.* Puerto Cortez, Tela, La Ceiba, etc., and it is in this region that the activity of the foreigners is mostly concentrated. Here bananas, rubber, cocoanut palms, etc., are grown, and there is a large fruit trade with New Orleans and Mobile. Several short lines run inward from the ports for the sake of the banana trade, which is much handicapped by difficulties of transport.

Nicaragua, the country of lakes, is more favoured in regard to means of communication than the other States. It has on the Pacific an excellent port in Corinto, the best harbour between Santa Cruz and Panama. The port is connected by rail to Leon, Managua and Granada, the last being on the lake of Nicaragua. From it there is direct communication by steamer down the lake and then by the river San Juan to Greytown on the Atlantic. A scheme is on foot to connect the Atlantic coast, between Greytown and Bluefields, with San Miguelito on the lake of Nicaragua, by a railway which would start from the bay of Monkey Pt.; but meantime this is progressing slowly on account of the difficulties involved.

As to the scheme of a Panamerican line the author does not think that this is likely to be realised in the near future. It is not the natural obstacles which present the greatest difficulty, but rather the fact that as each separate State produces practically the same articles, none has any great desire to facilitate communication with its neighbour.

All want primarily access to the two oceans, across which lie the natural markets for their products.

**The Geography of Textiles.**—M. Pierre Clerget contributes to *La Géographie* a very interesting article on this subject, which treats both of the raw material and of the industries in each case. As we have published here recently a considerable amount of matter on cotton and wool, we shall omit all consideration of these, and confine ourselves to a short summary of M. Clerget's statements in so far as they concern linen and silk.

The growth of flax and the manufacture of linen are of great interest both from their antiquity and from the way in which they are suffering from the competition of cotton. The steady replacement of linen for cotton is one of the interesting economic features of the nineteenth century, and has a variety of causes. Flax, though much more tolerant of climatic variation than cotton, is much more difficult to grow. It demands rich manuring and a long rotation, and is a very uncertain crop, being injured alike by an excess of humidity and by drought. In the north of France it is stated to prove remunerative only one year in three. Further, as is familiar to all, the fibre demands very careful preparation before it can be used, and must therefore be grown in countries where water is abundant, and labour cheap. The difficulty of production results in its being grown over small areas only, whence great variability in the product. Cotton, on the other hand, grown over vast areas, can be supplied to the manufacturers in much more uniform quality—a point of great importance in cheap manufacture.

As is well known, the flax plant is grown either for fibre or for seed, the fibre-yielding plants being pulled up before the seed forms. In Europe flax is a fibre-producing plant, in the Indies, Africa and America it is a seed-producing plant (linseed). Recently, however, an American process has been devised by which the fibre can be utilised after the seed has come to maturity, and if this process becomes general, the linen industry may recover some of its lost ground. Where water is too scarce to permit of the retting process, as in North Africa, the fibre is employed in the making of paper-pulp. At present Russia produces most of the fibre used in the linen industry.

The reasons for the steady replacement of linen by cotton fabrics are interesting. Raw cotton is actually dearer than raw flax fibre, but as cotton is less dense, a smaller quantity is necessary to produce an equal amount of thread, and the waste is less. Further, the pectose with which flax fibre is impregnated makes it much more difficult to work than the cotton fibre. This means that more power is required, more workmen are necessary, and the skill of the workman plays a considerable part. Thus forty to fifty workers can look after 10,000 cotton spindles, but ten to twelve times more are required for linen. In other words machinery has increased the productivity of the cotton worker 200 times, and that of the linen worker only fifteen times. We have thus the curious fact that the linen workers are badly paid and yet are more costly than the well-paid cotton workers, who are aided by excellent machinery.

In regard to silk, it is noticeable that though not a few caterpillars produce silk, yet it is the silkworm of the mulberry which yields nine-tenths of the world's silk. Though the mulberry is tolerant of a wide range of climate, yet the silkworms can only be reared where a second crop of leaves is obtainable, and this means a region where the average temperature for at least three months exceeds 54°·5 F. Roughly speaking the zone of the mulberry corresponds therefore to that of the vine. The silkworms are more sensitive to temperature variations than the mulberry, and would thus have a more restricted distribution, were it not that they can be reared in heated chambers, as is commonly done in Europe. The care which must be given to the worms excludes the industry from all regions where cheap and experienced labour is not available. In Europe only one harvest of cocoons is obtained, and the rearing process thus occupies only a portion of the year (April to July), but in Asia, where several harvests are obtainable, the labour of rearing is practically continuous throughout the year. In Europe the rearing process cannot be carried on in combination with those farm crops which make heavy demands upon labour during the rearing season, and on this account the silkworm is better fitted for a region of small than of large holdings (*i.e.* it is better suited to a region of *métayage* than to one of *fermage*). The necessity for cheap labour excludes the United States from the producing countries, and favours Italy at the expense of France. But in Europe generally, despite governmental efforts both in France and Italy, the total production is diminishing, while that of China and especially of Japan is increasing, and will probably continue to do so. The silk industry has suffered from the "democratisation of fashion," this being especially true of the figured materials which used to be the glory of Lyons. In order to reduce the price of the product, wool, cotton and linen have been mingled with silk, and the consequent modification of methods has favoured the American industry, as against the older European ones. Further, the aniline dye industry has introduced many modifications. In Europe commerce in silk is concentrated at Lyons and Milan, but Milan as an independent market exists only for Italian silk; for silks of other origin it is largely an *entrepôt* of the Lyons market. The great development of the United States industry is now threatening the supremacy of Lyons. New York is now, after Shanghai, the largest market for raw silk, and its importance will probably increase with the completion of the Panama Canal.

## General.

**The International Geographical Congress.** — Mr. Ralph Richardson, Joint Hon. Secretary of the Society, has received a letter from the secretary of the Tenth International Geographical Congress, stating that the Congress will not be held at Rome during the coming spring, as had been proposed, on account of the political situation. The Congress will, however, still be held at Rome, but at some date to be fixed hereafter.

## EDUCATIONAL.

Geological Map of Glasgow District.—The Geological Survey has undertaken a new departure in the recent publication of this map, which includes parts of Sheets 30, 31, 22 and 23, and is accompanied by a Memoir on the geology of the region (cf. vol. xxvii., p. 612). The map does not coincide with any one of the Ordnance Survey Sheets, but it is stated to have been specially prepared for economic and educational purposes, in order to illustrate the area of which Glasgow is the centre, and it may, therefore, be specially recommended to the notice of teachers.

We cannot here indicate all the interesting details which the teacher will find included in this memoir, but may draw special attention to the map in colours at the end of the pamphlet, which shows the pre-glacial features of the region as they would be seen were all the superficial deposits removed. This map shows that at Clydebank three great valleys converge, first, the great Bearsden Channel, now completely buried in drift; second, the valley to the west of Paisley, now occupied by the Black Cart; and third, the Clyde valley, the shallowest of the three. The map indicates how fiord-like was the appearance of these valleys till they were filled with detritus, a phenomena which is believed to have preceded the advance of the great ice-sheet. In the short but most instructive note which Mr. Hinxman contributes on the influences of geographical and geological conditions on the rise of the city of Glasgow, it is noted that the existence of a pre-glacial, drift-filled channel round and below the present Clyde near Glasgow has had much influence on the development of the port, for the alluvial filling was easily excavated and dredged in order to make docks and to deepen the channel. This is only one of the many interesting points which the memoir contains; it should be of the greatest use to teachers and to others engaged in education both in Glasgow and elsewhere, and we hope that similar maps and memoirs will also be published for the other great centres of Scotland.

Geographical Section of the Royal Philosophical Society of Glasgow.—We have received from Miss M. A. Hannan Watson, M.A., the syllabus of this section for the current session. Its aim is to encourage original work in geography among the members, and to give special assistance to teachers of the subject. The President is Dr. J. D. Falconer, who is to address the Philosophical Society in March on "Some Aspects of the Geography of Northern Nigeria." Among others who have already addressed the members this session, or are still to do so, we note the names of Prof. J. W. Gregory, Dr. Bruce, Mr. G. G. Chisholm, and Captain Charles H. Brown, while excursions are to be arranged after Easter. The annual subscription for members of the section is only 5s., and they obtain various privileges in addition to the right of attending sectional meetings. Further particulars can be obtained on application to Miss Hannan Watson, Joint Hon. Secretary, Laurel Bank School, Thornville Terrace, Hillhead, Glasgow.

# NEW BOOKS.

## EUROPE.

*Types of British Vegetation.* By Members of the Central Committee for the Survey and Study of British Vegetation. Edited by A. G. Tansley. Cambridge: University Press, 1911. *Price 6s. net.*

This book will supply a long-felt want in the study of Ecological Botany, and will be of great assistance to teachers and students of that subject, as well as to those interested in the study of Geography and Geology. The list of contributors includes the names of F. J. Lewis, C. E. Moss, F. W. Oliver, Marietta Pallis, W. Munn Rankin, W. G. Smith, and A. G. Tansley, all members of the Central Committee for the study of British Vegetation, and in addition those of Prof. Grenville Cole, Dr. R. W. Scully, and Prof. G. S. West.

Within recent years that wider study of plant-life which seeks to recognise and describe the different types of plant communities indigenous to this country, and to explain their relations as far as possible to climate and soil, has made great strides, and the present work owes its origin to the published papers and vegetation maps of workers who, in nearly every case, are members of the Committee. Of these papers, the first two, dealing with the Edinburgh and North Perthshire districts, appeared in the *Scottish Geographical Magazine* for 1900.

The present memoir is divided into three sections:—I. Introduction. The units of vegetation—their relationships and classification. II. The conditions of vegetation existing in the British Isles. III. The existing vegetation of the British Isles. Of these sections Part II., dealing with the conditions of vegetation in the British Islands, will be of most interest to the geographer and the geologist.

In any new branch of science the question of nomenclature is generally a vexed one, but in this book the various terms are carefully defined, and plant-formation, plant-association, and plant-society, are uniformly used throughout.

Following an able chapter on the physical characters and climate of the British Islands in relation to their vegetation, comes another on soils; and to Scottish geographers Dr. W. G. Smith's contribution on the soils of Scotland will be of especial interest. The absence of extensive deposits of limestone both in the rocks and the glacial drift formed from them, results in these soils being, generally speaking, non-calcareous, and vegetation typical of "siliceous" soil results. Most of the glacial "boulder clay" shows a tendency to promote an acid humus soil or an acid and relatively pure peat, and these, found up to about 3,300 ft., give rise to the extensive moorland vegetation so characteristic of Scotland. In the Highlands the climate and soils bring about well-defined types of vegetation, the west with its prevalent peat mantle supporting the "moor" type. In the wetter parts the moors are dominated by *Scirpus caespitosus*, in the drier eastern parts by calluna-moor and heath. The rarer Arctic-Alpine plants of the Central Highlands are dealt with in a special chapter in which the nature of the habitat—flat stony summits on the one hand, crags and corries on the other, are shown to be the determining factors for this vegetation. The soils of the Central Lowland Plain of Scotland are almost all of glacial or alluvial origin and are very fertile near the coasts. The Southern Uplands, consisting of Ordovician and Silurian "siliceous" rocks, provide excellent grazing ground for large numbers of sheep, owing to their grassy or heathery moorland.

Part III. concerns itself with the existing vegetation of the British Isles, and as habitat must be the basis of any natural classification, the treatment adopted is to give a general account of the various formations and associations recognised

from this standpoint. Space forbids our giving a complete list of the sub-sections, but as indicative of the methods employed, the following are given as representative titles of chapters:—The plant-formation of clays and loams; the vegetation of sands and sandstones; the heath-formation; the vegetation of calcareous soils; aquatic vegetation; the marsh-formation; the vegetation of the sea-coast.

The text is illustrated by a large number of excellent photographs, and there are maps and diagrams, one of the latter showing the relationships of British plant-formations.

*Rambles in the Black Forest.* By I. A. R. Wylie. London: Mills and Boon, Limited, 1911. *Price* 6*s.*

The editor of the Rambles Series may be congratulated on the excellence of his writers, and specially in this case. Miss Wylie's enthusiasm ought to carry many to the Black Forest who have not yet breathed its pine-scented air or rested in its pleasantly German inns. It possesses a *genius loci* of its own and is more unspoiled by tourists of our nationality than some places equally accessible. Travelling with the writer, we visit the chief, as well as some of the most secluded spots, spending a week in light-hearted Baden-Baden, and learn much of the history, legends, and popular customs of the country. The account of a village fête in Gutach is very curious, as is the mention of a stork with a broken wing which braves the winter cold of the Black Forest with the aid of a pair of red stockings. Excellent photos and some coloured illustrations are given, but we should have appreciated a map also. It would surely not be despised by "Ramblers."

*Casuals in the Caucasus: The Diary of a Sporting Holiday.* By Agnes Herbert. With 22 Illustrations. London: John Lane, The Bodley Head. New York: John Lane Company, 1912. *Price* 12*s.* 6*d. net.*

The best that we can wish for Miss Herbert is that she may go on for a long time visiting the less-known quarters of the earth, and writing books about them. It is one of her best qualities—not too common amongst travellers—that she enjoys herself to the full, and communicates much of that enjoyment to her readers. One does not mind covering over one hundred pages before reaching the hunting-grounds, for there is much entertainment by the way. Whether it is the theatrical rehearsal at Gibraltar, or the lady on the steamer with fond memories of a distant past, or the light but sufficiently comprehensive description of Caucasia and its peoples, there is so much shrewdness as well as humour, that the reader is very pleasantly carried along. In the chapters on hunting one finds much information casually conveyed on natural history and even ethnology. Very good sport was had and some good trophies obtained, tûr or ibex, grey bear, and ollen or stags; of birds, grey snipe, blackcock, and snow-pheasant were plentiful. The conclusion of the book, the escape from the Prince's Castle, is delightful, but will not bear condensation here. The photographs are excellent, but the best is a lovely double-page view of Kasbek.

*Cathedral Cities of Italy.* Written and illustrated by W. W. Collins, R.I. London: William Heinemann. New York: Dodd, Mead and Company, 1911. *Price* 16*s. net.*

To most of us who travel in Italy, the cathedral cities represent the whole country, for we speed through beautiful scenery in express trains wearying for the end of our journey. This book, therefore, by Mr. Collins will appeal very strongly, for not

only are the illustrations very beautiful and full of the colour of the country, but the descriptions are concise and well-written histories of the various places. Most of the towns are familiar, but some of these which are smaller and more remote are less well known and are well worth studying. Salerno, for instance, is of peculiar interest to us, for it possessed in its time a medical school so renowned that Robert, son of William the Conqueror, who was wounded in the Holy Land, lingered there for treatment, and lost his crown. The progressive periods of architecture are carefully indicated, and the book should be a useful guide to the traveller.

*The Southern Slav Question and the Habsburg Monarchy.* By R. W. Seton-Watson, D.Litt. Oxon. London: Constable and Co., Ltd., 1911.

Mr. Seton-Watson has divided his book into two rather unequal sections, the one dealing with the history of the Slavs from the most remote periods, and the other stirring up the uneasy story of the annexation of Bosnia, and the doings of Count Aerenthal generally. The countries involved are Croatia, Bosnia and Herzegovina, Servia, and other minor states. It is shown how these peoples came across from the direction of Russia in remote times, and settled side by side, fierce and independent races, always at war, gradually and inevitably being absorbed by Austria. One curious sidelight on the genius of the great Napoleon is shown in his temporary occupation of these countries, and the amazing amount of work he succeeded in effecting for their good in so short a time. It is said that later, when the Emperor Francis was visiting Dalmatia, on hearing that all the wonderful roads and other works had been done by the French, he remarked that it was a real pity they hadn't stayed longer! That part of the book which deals with the annexation of Bosnia and the circumstances which led up to it, is too political and controversial to be noticed at length here. The author's criticisms on Count Aerenthal's methods are, possibly quite rightly, very severe, but at the same time it is suggested that our own methods have not always been above suspicion, and the fact remains that Count Aerenthal has, partly by these very methods, raised his country from being a negligible quantity in the councils of Europe to being once more one of its leading nations and its second military power. Austria-Hungary is a great and rapidly growing country, and her progress should be watched by us with careful but sympathetic eyes.

## ASIA.

*Eighteen Capitals of China.* By William Edgar Geil, M.A., Litt.D., F.R.G.S., F.R.A.S., etc. London: Constable and Co., Limited, 1911. *Price 21s. net.*

We believe there can be very few people alive who will contest with Dr. Geil the record for travelling in China. Some years ago he described in one interesting volume his long journey on the Yangtse; later on in another he described his adventurous journey from the one end to the other of the Great Wall; and in the handsome and beautifully illustrated volume now before us he describes the "Eighteen Capitals of China." This work is in no sense a guide book, although we have in it interesting and graphic descriptions of the important cities visited and of the condition of their population. Dr. Geil has paid special attention to the movement, which for want of a better name we call unrest, which seems to be fermenting all over the empire. In almost every place to which he went he found ample evidence that China has awakened from its proverbial slumber. It has entirely changed its antiquated system of education, and, quietly but effectively,

it is training its soldiers to modern methods of war and arming them with modern weapons. This volume apparently was sent to the press before the news of the present rebellion in China reached America, for there is no special mention of it. Dr. Geil has also paid special attention to the literature of China, an interesting and complex subject, the history of which has yet to be written. About the third century B.C. Ch'in Shih Huang Ti did his utmost to destroy all the records of earlier periods. But, notwithstanding this, every province has a huge amount of more or less ancient records, much of them fantastic and puerile, but containing a certain amount of wheat which is well worth separating from the chaff. We know of the monumental encyclopædia, compiled, but never printed, in the fifteenth century, by order of the Emperor Yung Lo, which included 11,000 volumes, containing approximately 366,000,000 words, and of which odd volumes are still extant. And in the British Museum there is a copy of the encyclopædia of the Emperor K'ang Hsi, compiled in the seventeenth century, with 1628 octavo volumes of 200 pages each. But the local annals and literature are much more important to the antiquarian, historian, and ethnologist, and Dr. Geil has showed enlightened and praiseworthy zeal in already acquiring a considerable number of them for his own country. At Nanchang alone, for example, he was able to secure 118 volumes of annals of various counties.

A special word of commendation must be given to the many excellent photographs with which the book is illustrated. We most heartily recommend the perusal of this book to our readers; they will find it a delightful combination of instruction and amusement, and its appearance at this critical juncture in the history of China is very opportune.

*Burma: A Handbook of Practical Information.* By Sir J. George Scott, K.C.I.E. London: Alexander Moring, Ltd., 1911. *Price* 10*s* 6*d. net.*

This handbook of practical, commercial, and political information about Burma by Sir J. George Scott and a number of experts is one of the best of its kind which has come under our observation. It is a model of skilful condensation; and although the authors by the nature of their subjects have been compelled to give a good many statistics, their selection has been very judicious; and the average reader has no good ground of complaint. In passing we may observe that many of the statistics are now obsolete as the figures given have been superseded by those of the late census, which, however, were not available for this useful publication. The volume appeals to every one interested in Burma; the historian, ethnologist, antiquarian, archæologist, philologist, social economist, etc., down to the musician, sportsman, and tourist, will all find in it materials well worthy of their attention. It is not surprising that a second edition of the original work has been found necessary. The numerous illustrations are varied and good.

*Sport on the Nilgiris and in Wynaad.* By F. W. F. Fletcher. London: Macmillan and Co., Limited, 1911. *Price* 12*s. net.*

The charm and excitement of personal adventures and risks in pursuit of big game seem never to lose their power even in the case of the arm-chair sportsman, and on this ground alone we might recommend Mr. Fletcher's work to the perusal of our readers. It describes incidents and experiences in sport which occurred to him in the course of sixteen years' residence in the Wynaad district of Southern India. The Wynaad is, of course, well known to the Stock Exchange sportsmen as a

more or less happy hunting ground for gold but it is not so well known as the abode of *fera naturæ*—*e.g.* elephants tigers, etc. Mr. Fletcher is well qualified to make known its merits in that respect. He is a keen and enthusiastic sportsman, with ideas and acute observations of his own, ever ready to break a lance with recognised authorities like Sanderson, Baldwin, and Forsyth; he has a ready and graphic pen, and a strong sense of humour; he is a good *raconteur*, who does not hesitate to tell a story against himself; and one who fully appreciates and constantly recognises the courage, skill, and devotion of his shikarries. He has plenty thrilling incidents to narrate, while at the same time he contrives to convey to his readers much interesting information about the condition of Wynaad and the ways and doings of its inhabitants. His experiences and opinions regarding the weapons and paraphernalia to be taken on a big-game expedition are, of course, of special value to all who are fortunate enough to be able to attempt such an undertaking.

*The Civilisation of China.* By Herbert A. Giles, M.A., LL.D. London: Williams and Norgate. *Price* 1*s. net.*

In these days when public attention is inevitably directed to the stirring events going on in China, the appearance of a compendious work on the civilisation of China, by one who is an acknowledged authority on the subject, is very opportune and welcome. Dr. Giles, now Professor of Chinese at Cambridge, was formerly Consul at Ningpo, and in this volume, into a compass of 250 small pages he has compressed a vast amount of general information which at this time is very valuable. The work is an excellent example of judicious selection and condensation, and yet it is written in a graphic and pleasing style, so that the interest never flags. Dr. Giles says that he has written primarily for those who know little or nothing about China, but even those who have lived there for some time, and those who have studied other works on the subject, will find in this little book much material for serious reflection. Dr. Giles knows the Chinese well, not only in their literature and history, but in their daily life and habits of thought, and he has ample literary skill to place his own knowledge at the disposal of his readers. He does not conceal his admiration of the character of the Chinese, but he does not attempt to hide their faults and shortcomings. His readers cannot fail to receive a better impression than they ever had before of the vastness of China, and of the complexity, variety, and difficulty of the many problems which a political upheaval in China, such as is going on now, brings to the front.

*Life in the Moslem East.* By Pierre Ponafidine. Translated from the Russian by Emma Cochran Ponafidine. London: Hodder and Stoughton, 1911. *Price* 12*s. net.*

Of late years we have had quite a number of books describing life in the East in general, and more particularly in Persia, and in the handsome volume now before us we have a series of sketches of Eastern life at the hand of a Russian official of no less than thirty-six years of consular experience, a great part of which was spent in the principal cities of Persia. The sketches are interesting as setting forth the views and opinions of a Russian officer of sympathetic temperament, acute observation, and long experience, but they do not contribute anything fresh or novel to our knowledge of the countries and peoples described. From internal evidence it would appear that the sketches have been written at considerable intervals of

time, and have not been carefully revised so as to avoid needless repetition. For example, on page 82 in a chapter on "Sunnites and Shiites" we have a list of the twelve Imams, and a brief account of their ends; on page 98, in the chapter which is headed "Pilgrimages and carrying Bodies," we have the same information in practically the same words; and again on page 341 in a chapter on "Mourning Fasts and Feasts" we have a third account of some of the Imams. The Consul-General, we imagine, has prepared this book for the Russian public in the first instance, and he has not troubled himself to bring his facts and figures up to date. He made an expedition to India, that is to say, to Bombay, where he found the architecture of the public buildings to be very like "our white-stoned mother Moscow." In his chapter on India he uses the figures of the former census, now obsolete except for purposes of comparison. He was evidently much interested in the Thugs, and has devoted a chapter to a sketchy account of them, culled from old reports and Colonel Meadows Taylor's well-known *Confessions of a Thug*, and he remarks that "thanks to the English the *sect* has ceased to exist in India." So far from this being true, the Bengal police, only three or four years ago, reported a gang of some two hundred Thugs at work in the Dacca division, who conducted a successful and lucrative business by joining themselves to bands of pilgrims on the way to Mecca, and murdering them before they had gone many marches; besides this, it is well known that river piracy, which is only a particular form of Thagi, is still practised in Bengal.

The Consul-General is most successful when he is describing things Persian. He has given his readers a vivid picture of the miseries of life in Bagdad during the hot season, and a still more vivid and lurid description of life there during a cholera or plague epidemic. The reader will also enjoy his graphic descriptions of pilgrimages to Mecca, Medina, and other holy places, and his account of the Bedouins and Arabs at home. His chapter on the position of women all over the East is practically confined to the legal aspect as defined by the Koran, but the second chapter refers more particularly to the circumstances and ways of the women of Persia, and is much more interesting. There are some good illustrations, but there is a great want of a good map and index.

*Palestine and its Transformation.* By Ellsworth Huntington. London: Constable and Company, Limited. Boston and New York: Houghton Mifflin Company, 1911. *Price* 8*s.* 6*d. net.*

That the geography of a country has a paramount influence on its history and on the character of its inhabitants has been a commonplace truism, at least since the days of Buckle, and in no country is the truth of the saying better demonstrated than in Palestine. Dr. George Adam Smith's monumental work, *The Historical Geography of the Holy Land*, still holds the first place as the authority *par excellence* so far as the influence of geography on the history of Palestine is concerned. But much water has run below the bridge since it was published; the labours of the Palestine Exploration Fund and others have furnished many fresh materials, and amid the multitude of books which have been, and are being published about the Holy Land, there is ample room for the thoughtful and erudite volume now before us. We owe it to the enlightened generosity of the Yale University authorities who, in 1909, deputed the assistant Professor of Geography, who had already qualified himself for the task by extensive travels in the East, to proceed to Palestine for a purpose of worldwide importance which we must allow Professor Huntington to state in his own eloquent words. "The correct interpretation of history demands first a knowledge of man's mental, moral, and

spiritual qualities, that is, of the psychological character of human nature. Then it demands a knowledge of his surroundings, or of the mould in which generation after generation has been cast. The chief of all moulding forces is geographic environment—the form of the land where a man lives and obtains sustenance, the nature of the forests, swamps, or mountains to which he flees for refuge, and the character of the climate which determines his mode of life and fills him with lassitude or energy. The great Hebrew conceptions of God, and of the relation of God to man, and man to his fellow, might possibly have been moulded under conditions other than those of Palestine. We can have little doubt, however, that under such circumstances they would have assumed a form distinctly different from that which has gone forth from Judea to dominate the lands of the West. In Palestine, as perhaps nowhere else, the power of nature in moulding human actions and thoughts is plainly visible. There, too, in strangest contrast, faith and the power of ideals have triumphed more gloriously than in any other land. So strongly do these opposed aspects of history impress themselves upon the student, that more than its share of importance is often assigned to each, according as a man's mind is scientific or idealistic in bent. Hitherto Palestine has been studied chiefly by men filled with the idealistic spirit, that is, by those whose interest centres in the religious significance of the land or its contribution to thought, without respect to the relation of that thought to nature. Many authors, to be sure, have discussed the purely physical aspects of Palestine; but few have avowedly set themselves the task of explaining step by step the process by which geologic structure, topographic form, and the present and past nature of the climate have shaped man's progress, moulded his history, and thus played an incalculable part in the development of a system of thought which could scarcely have arisen under any other physical circumstances. The hope of aiding in the comprehension of this complex sequence, and of showing how natural environment prepared the way for the teachings of Christ, was the purpose of the Yale Expedition, whose work forms the basis of this volume."

The feature of this work which distinguishes it most readily from that of Dr. George Adam Smith, is the importance attached to the influence of climate, a subject to which about one-half of the book is devoted. Professor Huntington writes, "We were surprised to discover how closely historic progress and decline appear to have synchronised with changes in climate. At the end of our journey we found ourselves enthusiastic, not over the beauty of the country, for on the whole it is not beautiful, but over the marvellous way in which a knowledge of the physical geography of the land explains its eventful history, and lends unexpected interest to even the simplest of the old Bible stories."

We trust that enough has been said to show to our readers the intense interest of the work. We must add that the book is written in a spirit as reverent as it is scientific, and with all the literary grace and skill which we associate with Yale University. It is furnished with several illustrations and some excellent maps, and is sure to secure, what it certainly deserves, viz., a wide circle of all sorts of readers on both sides of the Atlantic.

## AFRICA.

*The Suk: Their Language and Folklore.* By Mervyn W. H. Beech. Oxford: At the Clarendon Press, 1911. *Price* 12*s.* 6*d. net.*

The author of this useful, if somewhat sketchy, monograph is an officer in the Colonial Service who makes no claim that his work is complete. Apparently he

compiled the materials for it during the scanty intervals of leisure which he can have enjoyed when acting as District Commissioner of Baringo in East Africa, and it comes to us with an appreciative introduction by Sir Charles Eliot, an authority second to none regarding the inhabitants of Equatorial Africa. Much obscurity and dubiety still exist as to the origin and history of the Suk tribe. According to Sir Charles Eliot, they belong to a group the best-known members of which are the once terrible Masai and the Turkana. They seem to have inhabited for some time the upper reaches of the Elgeyo escarpment, till they were able to move from there down to the plains, where they became agriculturalists and intermarried with other tribes to such an extent that Mr. Beech is able to say, "that amongst the Suk one finds an astonishing number of types. There every type is represented, from the tall, handsome Hamite, with almost perfect features, to the short, dwarf-like pigmy, with spread nose and bolting eyes. I am inclined to think that this latter type of physique characterises the original Chók and Seker." The main interest of this book, however, is to the anthropologist and philologist. Mr. Beech has devoted one-third of it to an interesting compilation and description of the customs, laws, dress, religion, etc., of the Suk ; the rest of the book is concerned with their language, grammar, and vocabulary, so that it will be a most useful volume of reference for any one who follows Mr. Beech in the administration of Baringo. We must add that it is illustrated by a number of good photographs.

*South Africa To-Day.* By H. Hamilton Fyfe. London : Eveleigh Nash, 1911. *Price* 10*s.* 6*d. net.*

In this well-illustrated volume we have a series of crisp and interesting sketches of several of the principal towns and scenes in South Africa. The author keeps to the beaten track, but his information is up to date, including, for example, the main features of the Duke of Connaught's late tour. We are taken to the diamond mines in Kimberley, the gold mines in Johannesburg, Rhodes' lonely tomb in the Matoppo Hills, the Victoria Falls and other places ; all districts often described but always interesting. Mr. Fyfe has a fluent, and at times an eloquent, pen, and he has also many shrewd and judicious remarks to make on several of the complex problems which have already come to the front in South African politics, such as the question of the supply of labour, inextricably mixed up with which is that of the immigration of Indians as labourers and traders, or again, the language question, *i.e.*, is English or the Taal to be the language of the future in South Africa. An important part of the book is devoted to a useful description of the various resources of Rhodesia, and Mr. Fyfe has much sound and wise advice to give to those who think of emigrating to that very attractive country. A careful perusal of the work impresses on the reader that South Africa is, and for some time must be, in the transition stage and in urgent need of development, and that it contains in itself all the elements and materials of prosperity and success, with the important exception of white population. As in Canada and Australia, it is white men that are wanted, strong, sturdy, persevering, enthusiastic, hopeful men, who are capable of roughing it for a few years, at the end of which they should have acquired a handsome competency. Great as are the mineral resources of South Africa, they are not equal to its agricultural wealth, which in course of time will cause it to become a formidable rival to Canada. Some day science will have successfully overcome many of the present climatic drawbacks, and then a farm in Rhodesia will be as desirable and as profitable as one in Alberta or Manitoba.

## AMERICA.

*Britain across the Seas: America. A History and Description of the British Empire in America.* By Arthur Granville Bradley. London: National Society's Depository, 1911. *Price* 12*s.* 6*d. net.*

This book comes out at an opportune moment when Canada has been so much in the public eye, both politically and commercially. Mr. Bradley has, by his previous writings, led us to expect a very high standard, and he has not disappointed us. We understand so imperfectly the all-important problems which are troubling our statesmen that fresh light from so competent a writer is very valuable. In order to make plain the essential differences between the peoples of Canada and the United States, Mr. Bradley commences with a brief but lucid history of the colonisation of America. He traces the early settlement of the Puritans of the *Mayflower*, fiercely republican, independent in creed, becoming more fanatical and intolerant as time went on. Canada, on the other hand, originally peopled by the French, was animated by the spirit of the *ancien régime*, and was rigidly Roman Catholic. Also, what is too often forgotten, the loyalist Americans who lost everything during the war were deported in a body to Canada, where they formed the nucleus of the British element. Such elements could only with difficulty coalesce, and they remain with little modification to the present time. The sympathies and aspirations of the two countries are widely different. The chapter dealing with Wolfe and the taking of the Heights of Abraham is a very inspiring piece of writing, and indeed the whole of that part of the book is full of lofty patriotism. We are a little apt to take our views of our behaviour during the war of independence from Thackeray, and it is a relief to find from so good an authority as Mr. Bradley that the mistakes were not all on the side of the British Government. Indeed the policy which was adopted towards Canada after its conquest was as enlightened as anything we could do to-day, too tolerant for the New Englanders of that time. The further history deals with the amazing progress and development of the Dominion.

The author holds that, while, a good many years ago, the imperial instinct was dormant on both sides of the Atlantic, now a much finer spirit has risen both in Canada and Great Britain, and the bonds of friendship are being drawn much closer. It is interesting to see, by his public utterances, that Earl Grey holds much the same views. It ought to be the endeavour of every one on this side to foster the growing spirit, and no better means for gaining the requisite knowledge could be devised than a careful study of Mr. Bradley's work.

*South America To-Day.* By Georges Clémenceau, formerly Prime Minister of France. London: T. Fisher Unwin, 1911. *Price* 12*s.* 6*d. net.*

M. Clémenceau, during a sojourn in South America, probably, although he does not say so, not unconnected with the Pan-American Congress, has taken the opportunity to make an exhaustive study of the new country of the Latin race. Anything from the pen of so distinguished a statesman and literary man must command attention, and the thoughtful reader will not be disappointed. The title might have been "Latin America by a Latin of the old country," for M. Clémenceau looks upon himself and his own countrymen as part of the great Latin race which is made up of France, Italy, and Spain, and he consistently keeps in view the attitude of this new world of Latins to the old country. He compares the difference of conduct between the Anglo-Saxon and the Latin when transported to such a new country as the Argentine. The Englishman never loses his nationality. He "dresses for dinner" even in the wilds, and runs home

regularly for a holiday. But the Latins lose themselves in their new surroundings. The three great branches gradually intermingle, and with the slight touch of Indian blood are producing a new and virile race with strong patriotic instincts and a splendid future. What M. Clémenceau pleads for is that those in the old country should keep in sympathetic touch with this new nationality which, in spite of all, is Latin to the core. What he has to say about the blending of the ancient Indian stock with the newcomer is worth attention, for the point of view is very different from that with which we are accustomed to face mixed marriages in our own possessions. "I should be inclined to say that the Indian simplicity, dignity, nobility, and decision of character might modify in the happiest way the turbulent European blood of future generations." Altogether we get an inspiring account of the prodigious progress which South America is making, and of its enlightened institutions.

*Old Indian Trails.* By Mary T. S. Schäffer. New York: G. P. Putnam's Sons. London: The Knickerbocker Press, 1911. *Price 7s. 6d. net.*

Mrs. Schäffer, the authoress of this dainty and beautifully illustrated volume, does not spend her summer holidays like the majority of her compatriots in Canada. For seventeen seasons she has prepared to betake herself to the comparatively little known tracts of the Rocky Mountains, and in this volume we have the story of two of these expeditions, viz. those of 1907 and 1908. Both of these expeditions started from Laggan on the Canadian Pacific Railway, and made for the regions adjacent to the headquarters of the Saskatchewan and Athabasca rivers, and so she had abundant opportunities of making or remaking acquaintance with such famous peaks as Mounts Robson, Columbia, Forbes, and many others well known to us now from the works of Dawson, Collie, Wilson, etc. Much and varied experience had brought home to Mrs. Schäffer the dangers she was bound to encounter in the course of these expeditions, and, albeit she does not boast, she makes it quite clear that she is a lady of iron nerve, splendid physique, great fertility of resource, and serene composure under difficult or even dangerous conditions. She must certainly enjoy the very real hardships and excitements which such expeditions entail, otherwise she would not have persevered with so many of them. For the details of the adventures, we must refer our readers to the book itself. In each expedition the members were well assorted. They had absolute and well founded confidence in each other and also in the horses, on whose endurance, skill, and willingness so much of the success of the expedition depended. The most depressing weather and perversity of circumstances failed to daunt their courage or to produce discontent; prompt and willing obedience was always accorded to the directions of "Chief." The volume is profusely illustrated by photographs taken by the two lady members of the party, and there is also a useful map of the tract through which the expeditions passed.

*The Lands of the West.* By Alexander Cross, Ex-M.P. for Camlachie. Glasgow: James Hedderwick and Sons, Ltd., 1911. *Price 1s. net.*

This volume is a reprint of a series of articles contributed by Mr. Cross to the *Glasgow Citizen*, describing his impressions and observations during a long tour he made on the other side of the Atlantic. As may be imagined, the articles are an *olla podrida*, from which all may select according to their taste—national life, politics, economics, personal anecdotes, and so on. His tour included the principal cities of the United States and of the Canadian Commonwealth, so he had plenty opportunity and scope for the compiling of amusing and often instructive papers,

but we venture to doubt if it was worth while collecting and reprinting them. We should add that there are many illustrations in half-tone and line drawing.

## AUSTRALASIA.

*On the Wallaby.* By E. M. Clowes. London: William Heinemann, 1911. *Price 6s. net.*

This volume contains a number of well-written sketches dealing with Victoria in general and Melbourne in particular. The writer is a lady who has qualified for her task by a residence of more than eight years in the colony, during which she has turned her hand to a good many things. "I have edited a woman's fashion paper, of sorts, and was dismissed because—I confess it—the compositors were quite incapable of reading my writing. I have written short stories and articles; I have decorated houses, painted friezes, made blouses for tea-room girls, designed embroideries for the elect of Toorak, even for the sacred denizens of Government House. I have housekept, washed, ironed, cooked. Once I made a garden, drew out the estimates, engaged the men, bought soil and manure, shrubs and plants, laid out a croquet-lawn, delved, sowed, and planted shrubs." Her own career points the lesson of her book. In Victoria you must be young, able and willing to put your hand to anything, free from uppishness and snobbery, prepared to fight your own battle, and indeed to enjoy the fight. Miss Clowes does not give us any specially fresh information about Victoria or Melbourne, but she portrays what she herself has seen with cheerfulness, sagacity, and accuracy. She imparts a good deal of useful information as to wages, rents, and economic conditions generally, and she paints for us a kindly and good-humoured picture of Melbourne society in its various grades. Like all who have lived there she anticipates a splendid future for it, although there are not a few perplexing problems on the wise solution of which much of the prosperity of the future will depend.

## POLAR.

*A Tenderfoot with Peary.* By George Borup. With a Preface by G.W. Melville, Rear-Admiral U.S.N. (retired). With 46 Illustrations from Photographs and a Map. London: Eveleigh Nash, 1911. *Price 6s. net.*

From the title and from the few words of English scattered throughout the book one gathers that Mr. Borup was a member of the recent Peary Arctic Club Expedition. The numerous excellent photographs, and a good map on the "gore" system also help to confirm that impression. But a book of over three hundred pages written continuously in what we suppose is base-ball slang or the American University vernacular is more of a "freak production" than a serious contribution to literature. It is, however, a proof that high spirits and hard work are not incompatible.

*My Attainment of the Pole. Being the Record of the Expedition that first reached the Boreal Center, 1907-1909, with the Final Summary of the Polar Controversy.* By Dr. Frederick A. Cook. New York: The Polar Publishing Co., 1911. *Price 12s. 6d. net.*

For most people the title of this imposing volume will suffice—it adequately characterises its contents. Those, however, who are curious to follow in detail Dr. Cook's "attainment"—or otherwise—"of the Boreal Center," will find ample accounts of his wrongs within its covers, and will note that the author manifests as little regard for the canons of good taste in the making of accusations as in constructing titles.

## GENERAL.

*Secrets of the Hills and how Ronald read them.* By STERLING CRAIG, M.A., LL.B. London: George Harrap and Company, 1911. *Price* 3*s.* 6*d. net.*

It was the late R. M. Ballantyne who brought to perfection the art of combining instruction with entertainment. The device of conveying information in the form of a story is one that requires considerable skill, and we are not sure that Mr. Craig has been very successful. Elementary geology is not exactly a science which lends itself to light treatment, and we have in this volume many pages which can only be described as "dreich." The free use of inverted commas, and such interpolations as "said the doctor," are not in themselves sufficient to make a story, and we think that Mr. Craig would have been well-advised to leave Ronald and the other puppets out. Apart from this defect, the account given of our chief rocks and minerals is clear and straightforward.

*Who's Who.* 1912 London: A. and C. Black. *Price* 10*s. net.*

*Whitaker's Almanack.* 1912. London: Joseph Whitaker. *Price* 2*s.* 6*d.*

*Official Year-book of the Scientific and Learned Societies of Great Britain and Ireland.* Twenty-eighth Annual Issue. London: Charles Griffin and Co., 1911.

These invaluable reference books have made their usual annual appearance. We notice that *Who's Who* gets larger year by year, and feel that the bulk might be diminished with advantage by the ruthless editing of some of the entries, which often contain information of little public interest. *Whitaker's Almanack* has been increased in size, the new articles including some of definitely geographical importance, which greatly enhance its value as a work of reference.

*Asia and Europe.* By MEREDITH TOWNSEND. London: Constable and Company, Limited, 1911. *Price* 5*s. net.*

A pathetic interest attaches to the volume now before us, a fourth reprint of a number of thoughtful and instructive articles, which originally appeared in the *National Review*, the *Contemporary Review*, and the *Spectator*, from the pen of Meredith Townsend who died last October. The *motif* of the articles is to show that Europe cannot be the permanent master of Asia, and, conversely, that Asia is not likely to invade Europe again. Since the first edition appeared, the Russo-Japanese war has provided much additional materials for reflection on these important and complex questions; and now the general unrest in the East may be looked on in the same light. The articles deserved and attracted much attention when they first appeared, and are still well worth the study of all who are interested in the ever-varying relations of Asia and Europe.

## BOOKS RECEIVED.

WE have received the following new books:—

*Trekking the Great Thirst: Sport and Travel in the Kalahari Desert.* By ARNOLD W. HODSON, F.R.G.S. Edited by A. E. NELLEN. With Introductory Note by Sir RALPH WILLIAMS, K.C.M.G., and a foreword by F. C. SELOUS. With 4 Maps and 85 Illustrations. Demy 8vo. Pp. 359. London: T. Fisher Unwin, 1912. *Price* 12*s.* 6*d. net.*

*A Geography of the World.* By B. C. Wallis, B.Sc. (Lond.), F.R.G.S. Cr. 8vo. Pp. xvi + 372. London: Macmillan and Co., Ltd., 1911. *Price* 3*s.* 6*d.*

*From Constantinople to the Home of Omar Khayyam.* Travels in Transcaucasia and Northern Persia for Historic and Literary Research. With over 200 Illustrations and a Map. By A. V. Williams Jackson. Medium 8vo. Pp. xxxiii + 316. New York: The Macmillan Company, 1911. *Price* 15*s. net.*

*Natal Province Descriptive Guide and Official Handbook.* Edited by A. H. Taylor. Published by Authority. Imp. 8vo. Pp. xi + 575. Durban: South African Railways Printing Works, 1911. *Price* 7*s.* 6*d. net.*

*2000 Miles on Foot: Walks through Great Britain and France.* By E. W. Fox. With Portrait and 87 Illustrations by the Author. Cr. 8vo. Pp. xiii + 311. London: The Walter Scott Publishing Co., Ltd., 1911. *Price* 6*s.*

*Alone in West Africa.* By Mary Gaunt. Demy 8vo. Pp. xix + 404. London: T. Werner Laurie, 1912. *Price* 15*s. net.*

*My Tropical Isle.* By E. J. Banfield. Demy 8vo. Pp. 315. London: T. Fisher Unwin, 1911. *Price* 10*s.* 6*d. net.*

*Les États-Unis du Mexique.* Par Comte Maurice de Périgny. Préface de M. Marcel Dubois. Sm. Ry. 8vo. Pp. xi + 305. Paris: E. Guilmoto, Éditeur, 1911. *Prix* 5 *fr.* 50.

*Fascinating Egypt, Season* 1911-1912. A Bilingual Guide-Book to Nile-land and its wonders, from the Delta to Uganda and British East Africa. Compiled and edited by Leo Weinthal, F.R.G.S. Fifth Annual Issue. Fcap. 8vo. Pp. 328. London: African World, Ltd.

*Traité de Géologie Vol. II.: Les Périodes géologiques* (Fascicule 3e). Par Émile Haug. 290 figures et cartes et 64 planches de reproductions photographiques hors texte. Med. 8vo. Pp. 1397 to 2024. Paris: Librairie Armand Colin, 1911. *Prix* 11 *fr.*

*Les Royaumes des Neiges (États Himalayens).* Par Charles-Eudes Bonin. Avec 3 cartes dans le texte et 16 planches de reproductions photographiques hors texte. Cr. 8vo. Pp. x + 306. Paris: Librairie Armand Colin, 1911. *Prix* 4 *fr.*

*Kerala, the Land of Palms.* By J. H. Hacker. With 4 Coloured Plates and 63 Illustrations. Followed by *Through the Eyes of the Island Children.* By Basil Mathews, M.A. Cr. 8vo. Pp. 139. London: London Missionary Society, 1912. *Price* 2*s.*

*Plant Life: A Text-Book of Botany for Schools and Colleges.* By Prof. Dr. Eug. Warming, of the University of Copenhagen. With 250 Illustrations. Cr. 8vo. Pp. 244. London: George Allen and Co., Ltd., 1911. *Price* 4*s.* 6*d. net.*

*Die Sunda: Expedition des Vereins für Geographie und Statistik zu Frankfurt am Main.* Von Dr. Johannes Elbert. Festschrift zur Feier des 75jährigen Bestehens des Vereins. Band I. Demy 4to. Pp. xxxv + 274. Frankfurt am Main: Druck und Verlag von Hermann Minjon, 1911. *Preis m.* 40.

*Elements of Astronomy, familiarly Explaining the General Phenomena of the Heavenly Bodies and the Theory of the Tides.* Illustrated with eighteen copper Plates to which is subjoined a complete set of questions for examination. The whole adapted as well to the use of Private Students as Public Seminaries. By Joseph Guy. Pp. xii + 170. *Price* 5*s.* London: Baldwin, Cradock and Joy, 1819. **Presented by N. M. Johnston.**

*Modern Geography.* A Description of the Empires, Kingdoms, States, and Colonies, with the Oceans, Seas, and Isles; in all Parts of the World; including the most recent discoveries and Political Alterations, Digested on a new Plan. By John Pinkerton. The Astronomical Introduction by the Rev. S. Vince,

A.M., F.R.S. With Maps. Cr. 8vo. Pp. lxvii+641. London: T. Cadell and W. Davies, 1803. *Price* 13*s.* 6*d.* Presented by N. M. Johnston.

*The Sussex Coast.* By Ian C. Hannah, M.A. Illustrated by Edith Brand Hannah. Cr. 8vo. Pp. 409. London: T. Fisher Unwin, 1912. *Price* 6*s. net.*

*About Algeria, Algiers, Flemcen, Constantine, Biskra, Timgad.* By Charles Thomas Stanford, F.S.A. With a Map and 32 Illustrations from Drawings by F. Dorrien Thoroton, and from Photographs. Cr. 8vo. Pp. 305. London: John Lane, 1912. *Price* 5*s. net.*

*Text Book of Topographical and Geographical Surveying.* By Major C. F. Close, C.M.S., R.E. Ry. 8vo. Pp. vi+288. London: His Majesty's Stationery Office, 1905. *Price* 3*s.* 6*d.*

*The Year-book of the Scientific and Learned Societies of Great Britain and Ireland*, 1910-11. Twenty-eighth Annual Issue. London: Charles Griffin and Co., Ltd., 1911.

*The Official Year-Book of New South Wales*, 1909-10. New South Wales: 1911.

*Oliver and Boyd's Edinburgh Almanack and National Repository for* 1912. Being Leap-Year. Seventy-sixth year of publication. Edinburgh: Oliver and Boyd, 1912. *Price* 6*s.* 6*d. net.*

*Fourth Report of the Wellcome Tropical Research Laboratories at the Gordon Memorial College, Khartoum.* Volume B. General Science, by Andrew Balfour, M.D., B.Sc., F.R.C.P. Edin., D.P.H.Camb., Director. Khartoum: Department of Education, 1911. *Price* 18*s. net.*

*Second Review of some of the Recent Advances in Tropical Medicine, Hygiene and Tropical Veterinary Science, being a supplement to the Fourth Report of the Wellcome Research Laboratories at the Gordon Memorial College, Khartoum.* By Andrew Balfour, M.D., B.Sc., F.R.C.P.Edin., D.P.H.Camb., and Captain R. G. Archibald, M.B., R.A.M.C., attached E.A. London: Published for Department of Education, Sudan Government, Khartoum, by Baillière, Tindall and Cox, 1911. *Price* 15*s. net.*

*Statistical Abstract for the Several British Self-governing Dominions, Crown Colonies, Possessions, and Protectorates in each year from* 1896 to 1910. Forty-eighth number. London: His Majesty's Stationery Office, 1911. *Price* 1*s.* 10*d.*

*Iron and Steel*, 1910. Copy "of Memorandum and Statistical tables showing the production and consumption of Iron Ore and Pig Iron, and the production of Steel in the United Kingdom and the principal foreign countries in recent years, and the imports and exports of certain classes of Iron and Steel Manufactures." London: 1911.

*Diplomatic and Consular Reports.*—Trade and Commerce of Lingat, 1910-11 (4821); Trade of Muscat, 1910-11 (4822); Trade of the Consular District of Bushire, 1910-11 (4823); Trade of Bangkok, 1910-11 (4824); Trade and Finances of Greece, 1909-11 (4825); Trade and Commerce of Trieste, 1910 (4826).

*Colonial Reports, Annual.*—Barbados, Report for 1910-11 (698); Trinidad and Tobago, Report for 1910-11 (699); Mauritius, Report for 1910 (700); Grenada, Report for 1910 (701); British Guiana, Report for 1910-11 (702); Jamaica, Report for 1910-11 (703).

*Publishers forwarding books for review will greatly oblige by marking the* **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

# THE "DEEPS" OF THE PACIFIC OCEAN AND THEIR ORIGIN.

By Prof. JAMES GEIKIE.

*(With Map.)*

GEOLOGISTS and geographers have long been agreed as to what are the outstanding features of the lithosphere. They have no difficulty in distinguishing an elevated portion over which the continents and larger islands are distributed, and a more extensive flat basin-like depressed area occupied by the ocean. To this depression, however, the waters are not confined, for relatively shallow seas invade the less elevated parts of the land-bearing region. In other words, considerable portions of the true continental area are submerged. This elevated although partially submerged region of the lithosphere is termed the "continental plateau," while the more depressed portion is known as the "oceanic basin." Throughout the geological past many modifications have been effected in the form and extent of both areas, but we have no reason to believe that the two have ever changed places. As the earth is a cooling and contracting body, subsidence must obviously have been the dominant movement of the crust—necessarily affecting both continental plateau and oceanic basin, but reaching its maximum in the latter. The oceanic basin, therefore, has in the course of time become more contracted, and is probably deeper now than ever before, while the continental plateau is probably more extensive, and dry land more continuous than in earlier ages.

The coasts of our existing continents nearly coincide in some tracts with the margin of the continental plateau: in other regions

they retire from that margin for great distances. In the former case they show a regular outline—long inlets of the sea are of infrequent occurrence, and fringing islands rarely appear. In the latter case, however, the coastline is extremely irregular—inlets large and small are numerous, while fringing islands usually abound. The descent from the margin of the continental plateau to the oceanic basin within the Pacific area is generally abrupt. Along the west coasts of South and North America, for instance, the sea-floor shelves more or less gently until a depth of 100 fathoms is reached, and then it plunges down steeply to 500 or even 1000 fathoms or more before it begins to flatten out. Deep water, in short, is reached along the whole west coast of the Americas, at no great distance from the land.

Very different conditions obtain along the coasts of Asia and Melanesia. In those regions the continental plateau is so extensively submerged that only in Kamchatka does the coast of the mainland approximately coincide with the margin of the former. In the far north that margin is bounded by the Aleutian Islands, whence it follows the coast of Kamchatka and the east coasts of the long festoons of islands that extend southward by the Philippines to Tulur Island. After this it is difficult, owing to the manifold irregularities of the sea-bottom, to trace any distinct line of separation between continental plateau and oceanic basin. It must be drawn outside of Melanesia, however, for New Guinea, the Admiralty Islands, Bismarck Archipelago, the Solomon Islands, New Hebrides, New Caledonia, and the Fiji Islands all belong apparently to the continental plateau. The line of demarcation we are looking for again becomes recognisable between Fiji and the Samoa Islands—the edge of the continental plateau forming a well-marked feature that extends south-south-west in a nearly straight direction, from a point some fifty miles south of Samoa, towards the north-east corner of New Zealand—a distance of about 1150 miles. For our present purpose it is unnecessary to follow it farther.

The oceanic basin within the Pacific sinks to an average depth of 2400 fathoms or thereabout. Throughout very extensive areas it is approximately level or broadly undulating. This is markedly the case beyond the Oceanides, or throughout what may be termed the American section of the basin. Within the region of the Oceanides its surface is naturally less monotonous. Could the water be removed we should see many isolated peaks, sporadic groups of mountains, and now and again abrupt mountain ridges traversing the wide flats of that region in a general north-west and south-east direction. In the far north the continental plateau would be observed rising steeply as a pronounced escarpment in front of what are now the Aleutian Islands. The long festoons of islands, extending from Kamchatka south-west and south as far as Tulur Island—a distance of 4000 miles —would similarly be flanked by great escarpments. Between Tulur Island and Samoa, however, the plateau would probably appear less conspicuous, declining gradually to the floor of the basin. From Samoa south to New Zealand the escarpment of the plateau would again come prominently into view. On the American side of the basin an equally

conspicuous escarpment, as already indicated, would overlook the depressed floor of the basin along the whole extent of the double continent from Alaska to the extreme end of South America.

The Pacific, as every one knows, is in places much deeper than 2400 fathoms—depths of over 5000 fathoms having been sounded. Of these "deeps," as they are called, there are two kinds, which differ from each other especially in form and distribution. One kind is essentially trough-shaped and confined to the marginal zone of the oceanic basin; the deeps of this type, in point of fact, trend along the base of the escarpment of the continental plateau. Here it is that the greatest depths of the ocean are met with. The cross-section of those marginal troughs is essentially the same everywhere—the South American deeps being identical in shape with those of the northern and western borders of the Pacific. The latter, however, are not only somewhat deeper, but longer and more continuous. The accompanying section (Map, Fig. 1) across the Pacific from Japan to North America shows the Tuscarora deep of the great Japanese Trough. It will be observed that the sea-floor descends from the coast at a somewhat high angle to the depth of 4600 fathoms, after which it rises with a much gentler gradient until the level floor of the ocean is reached at a depth of a little over 2000 fathoms. The deepest part of the trough, therefore, lies relatively close in shore or at the foot of the continental escarpment.

The bottom of the Aleutian Trough is somewhat irregular, varying in depth from 3000 to 4000 fathoms. It extends from the Alaskan Peninsula along the whole front of the arc of islands, and is almost continuous with the enormous Japanese depression. The latter skirts the outer coasts of the Kurile Islands, Japan, and the Bonin Islands, with a depth ranging between 3000 and 4600 fathoms—the deepest part of the trough throughout its whole extent lying nearest the land. South of the Bonin Islands the festoon of the Mariana or Ladrone Islands is similarly fringed on the east by another trough, in which depths between 3000 and 5000 fathoms occur. The Philippine Trough begins opposite the Riu Kiu Islands and extends along the whole eastern margin of the Philippines to Tulur Island, at a depth of 3000 to 4700 fathoms—the greatest depths, as in all other cases, lying closest in shore. No trough appears in front of any of the northern islands of Melanesia between Tulur and Fiji. But we again encounter a very elongated depression—the Tonga-Kermadec Trough—stretching between the Samoa Islands and the north-east corner of New Zealand—the greatest depths of which range from 4000 to 5600 fathoms. (See "Aldrich Deep" in the Section, Fig. 2.)

Along the west coast of the Americas troughs are hardly so notable in extent and depth as those on the other side of the ocean. The most remarkable are the sinks that occur at intervals close in shore between Callao and Valparaiso. These consist of an elongated series of troughs or of one greatly extended trough of irregular depth—the depths nearest to the land varying from 2500 to upwards of 4100 fathoms. (See Fig 2.) No deeps of any importance have been charted along the

west coast of North America, but deep water, as already remarked, is met with at no great distance from the shore, the sea-floor after a short interval suddenly sinking to depths of 1000 or 2000 fathoms or more. (See Fig. 1.)

It will be observed that the depressions now described are all connected with the margin of the continental plateau—they occur either along the coasts of existing continents (South America, Alaska, Kamchatka) or along those of continental islands (Asiatic island-festoons). There is yet another kind of deeps of which mention must be made. These, unlike the troughs, have no connection with the margin of the continental plateau, but are characteristic rather of the central part of the oceanic basin. The majority occur west of meridians 150 and 160 west, but as large areas of the ocean have been only partially sounded, similar depressions may yet be discovered elsewhere. The deeps in question are not narrow elongated troughs like those that skirt the base of the continental plateau, but broad flat-bottomed basins of irregular form and often of great extent. They range in depth from 3000 to 3800 fathoms, and thus lie some 600 to 1400 fathoms below the general level of the ocean floor.

Before attempting to discuss the origin of the deeps of the Pacific it will be necessary in the first place to consider very briefly the more notable geological features of the lands which are bordered by troughs. The latter are so frequently associated with a certain geological structure that a causal connection between the two is at once suggested. Professor Suess, the distinguished geologist, believes that there is such a connection, that the troughs are characteristic accompaniments of folded mountains, and that those of the western Pacific came into existence at the same time as the young uplifts that girdle the ocean in that region. It may be of interest, therefore, to consider this theory with some attention, and for this purpose I shall first take a rapid glance at the chief orographical features of Asia—for it would seem as if the theory in question had been suggested to its able author by his study of the physical geology and geography of that continent. Professor Suess's conception of mountain development is founded on so wide a range of evidence, and explains so many phenomena, that it must to a large extent be true. Geologists who may not accept it in its entirety will nevertheless admit its suggestiveness and recognise its author's comprehensive grasp of a complex and difficult subject. Nothing can be more convincing than the picture he has drawn of the gradual evolution of the mountains of Asia. He introduces us first to a very ancient tract, named by him "Angara Land," which had been rendered stiff and rigid by compression before Cambrian times. This primeval land—the nucleus of the continent—extended from the far north down to the vicinity of Irkutsk, and it was around its southern outskirts that crustal compression caused the earliest Asiatic mountains to appear. These horseshoe shaped or arcuate ranges were the first and therefore the innermost of many similar mountain-arcs, which at long intervals of time were successively uplifted farther and farther away from the heart of the continent. Towards the east we traverse these concentric arcs, one after another, until we reach the great

island-festoons off the Asiatic coast. Towards south and south-west the grand succession of uplifts terminates in the gigantic Himalayas and the long series of ranges that extend into Europe. In all these chains the unilateral crustal thrust which brought them into existence has been persistently outwards from the interior of the continent—that is, east, south-east, south, and south-west.

The youngest uplifts on the Pacific side are represented by the great island-festoons just mentioned, and as the profound coastal troughs lie in front of these youngest mountains they are termed "foredeeps" by Suess. He shows that the long mountain-arc constituting the island-festoons exhibits a definite serial order of elements. The first element, on the outside or convex side of the arc, is the foredeep: then follows a belt of Tertiary deposits, often disturbed and folded. To this belt succeeds a concentric "cordillera" or ridge or series of ridges of older rocks which are folded to the east—that is, towards the oceanic basin. Lastly comes the volcanic arc, which is confined to the folds of the cordillera—no volcanoes ever occurring in the foredeep. This series of elements is sometimes incomplete but never inverted. The cordillera, for instance, may be wanting, but the volcanoes, active, dormant, or extinct, are rarely absent.

Dana long ago thought that the scattered islets of Oceania are the crests of submarine ranges, and Professor Suess is of the same opinion. He tries to show that the structure of the Asiatic festoons is repeated in them. But that is true only of the islands that pertain to the continental plateau. Outside of that plateau, in the true oceanic basin, the islets appear to be entirely devoid of the "cordillera element." Some of them show limestone which is probably of Tertiary age: many are volcanic, while a large number consist of recent coral above and no one knows what below. The linear direction of many of the island groups is certainly suggestive, and one can have no doubt that they are really mountains. But whether all or any of them are the result of crustal thrust from the direction of Asia, and built on the same plan as the island-festoons that fringe the Asiatic coast, seems more than doubtful. The majority rise abruptly from considerable depths, and, so far as one can judge from the soundings, are suggestive rather of volcanic forms than folded mountain-ranges. The linear and curvilinear arrangements of certain island-groups do not necessarily indicate uplifts like those of eastern Asia. Volcanoes, as every one knows, are often similarly aligned, although not infrequently they may be grouped irregularly, or occur sporadically, each soaring above its surroundings in solitary majesty. As the islets of Polynesia are distributed in very much the same way, the probabilities are strongly in favour of their volcanic origin. The soundings, it may be added, do not indicate the presence of any so-called "foredeeps."

Foredeeps, according to Suess, would seem to be of the same age as the ranges in front of which they occur. His account of their origin, however, is perhaps not quite so clear as it might be: at all events I have some difficulty in realising exactly what he means. He refers with approval to Supan's conjecture that the troughs are connected with fold-

ings, remarking that "it is indeed obvious that this is the case."[1] He states further that the depressions in question "mark the subsidence of the foreland beneath the recent folds," but is careful to note that the foredeeps are not synclines in the tectonic sense of the word, for one side belongs to the foreland, the other to the folded mountains. In another place he remarks that "if we could remove the hydrosphere, a vast land would lie before us at a depth of 3600 to 4000 metres below the existing sea-level, but in front of the folded arcs [*i.e.* the Asiatic island-festoons] we should see elongated strips of land, no doubt not completely regular, which would lie 2000, 3000, or even 5000 metres lower than the vast tract of newly exposed land. This great tract of land is the foreland. *The outer border of the foredeep is the arcuate border of a subsidence of the lithosphere, and the inner border of the foredeep is the outer border of the folded range* which has advanced from the direction of the land over this deep."

It is difficult to reconcile these several statements. From one of them we are led to infer that the foredeep is a downward bend of the crust caused apparently during the advance of the folded range, and we picture to ourselves a range slowly advancing—the foreland at the same time subsiding beneath and in front of it. But as some of the foredeeps are 20,000 to 33,000 feet in depth, or 5600 to 18,600 feet below the general level of the ocean-floor, we can hardly suppose that depressions so great can be downfolds of the same age and origin as the mountains. If such were indeed their origin, then we should expect the depth and extent of the depressions to bear some relation to the size and height of the islands behind them. But the soundings on the charts clearly prove that such is not the case. The deepest depressions do not always lie in front of the largest and loftiest islands, nor are the less important deeps associated only or chiefly with the smaller islands. No doubt Professor Suess recognised these facts and knew that his foredeeps could not be accounted for by ordinary mountain-folding. This is probably why he considers the outer border of these foredeeps to be the margin of a great depression that affected all the region lying in the direction of Asia—"the subsidence was the primary phenomenon." It was over that subsided area that the mountains are supposed to have advanced from the west, but, strange to say, all stopped short at practically an equal distance from the margin of the great downfold or steep front of the "foreland." Why should they have done so, and why should the front of the mountain-arc and the "arcuate border" of the supposed subsidence be so exactly concentric? And what about the enormous Tonga-Kermadec Trough?—Are we to surmise that here also a mountain-range has advanced from the west over a deeply depressed area of the sea-floor, and stopped, like all the ranges of the Asiatic island-arc, just before it reached the outer border of the supposed subsidence?

There is another question which I think will be hard to answer. The islands of Melanesia represent, according to Professor Suess, an

[1] The quotations are from *The Face of the Earth*—the English translation of Professor Suess's monumental work, *Das Antlitz der Erde*,—vol. iv. pp. 295, 505. The corresponding pages of the original are Bd. iii. 2, pp. 335, 336, 581.

Australian system of more or less concentric mountain-arcs, all of which are folded over to north-east. The evidence, although not so complete as could be desired, certainly favours that conclusion. The Australian arcs confront the oceanic basin in the same manner as the arcs of Asia; but where are the foredeeps which ought to occur in front of at least some of these Melanesian islands, if the theory under consideration were true? *The soundings on the charts show that no deeps are there.* It may be said that the outermost and youngest of these Australian arcs may be of Mesozoic age, and much older therefore than the island-arcs of Asia, and that any foredeeps which might at one time have existed may now be masked or concealed by marine sediments. But that cannot be the true explanation, for the great Tonga-Kermadec-New Zealand ridge (inferred by Suess to be a range folded towards the east) is at least as old as any of the outermost arcs of Melanesia, and yet it is flanked by one of the deepest troughs of the Pacific. (Map, Fig. 2.)

The mountain uplifts that constitute the Asiatic island-festoons, as we have seen, are all relatively young—they are of Tertiary age. Folded mountains of approximately the same age occur elsewhere, and we may ask, therefore, if foredeeps occur in connection with these. Professor Suess believes that they do. He refers, for example, to the Persian Gulf, which he looks upon as the foredeep of the Iranian Mountains; while he recognises the foredeep of the Andalusian Mountains in the valley of the Guadalquivir. Neither the one nor the other, however, is at all comparable to the troughs of the Western Pacific—even when all allowance has been made for silting-up. In other cases cited, the occurrence of foredeeps is purely conjectural and cannot be proved. The delta of the Tigris and Euphrates may occupy a depression, and so likewise may the delta of the Ganges and the Brahmaputra, but we do not know that this is true—it is only an inference. If masked foredeeps are actually present in either region, all one can say is that they must be relatively insignificant as compared with the profound deeps of the Pacific. And the same remarks apply equally to the Alps and the Carpathians, in front of which great subsidences are supposed by Suess to be concealed beneath thick sheets of marine Tertiary deposits. If the depths of these problematical foredeeps be at all proportionate to the dimensions of the mountains behind, they should be measured by thousands of feet. But who can believe that the young Tertiary deposits of Central Europe can even distantly approach a thickness of thousands of feet?

Professor Suess is careful, however, to point out that foredeeps do not in all cases occur: some mountains, he remarks, have gradually flattened out and therefore never possessed foredeeps. He has further suggested that foredeeps might occasionally have been obliterated by the advance of a folded range. "All such ranges," he says, "impelled by the general struggle for space, have a tendency to enter into the subsidences . . . or to overthrust the subsidences, or to throw the subsidences themselves into folds."[1] So that if the Asiatic island-arc

[1] *Das Antlitz der Erde*, Bd. iii. 2, p. 722; English Trans., vol. iv. p. 627.

throughout its length had only advanced equally for a few miles further, the deep concentric troughs that now exist would have been closed up or obliterated!

While foredeeps in my opinion are not characteristic, necessary, or essential accompaniments of folded mountains, and can be otherwise explained, I do not deny that subsidence of the crust may frequently have been caused by mountain-building. One can hardly doubt that considerable sagging must have taken place under the weight of such heaped-up rock-sheets as constitute the bulk of the Alps and other great chains. These mountains, it should be remembered, do not consist exclusively of strata folded and buckled up *in situ*. Folded and convoluted strata are no doubt always present, but most ranges seem built up mainly of enormously thick rock-sheets which have been driven forward, often for considerable distances, and piled one on top of another. The heaping of all these stupendous rock-sheets to a height of probably not less in many cases than 10,000 or even 15,000 feet must have had some effect in depressing the area invaded: not only broad foredeeps, but similar backdeeps also might have come into existence. It is further not improbable that if volcanoes were subsequently developed in such a range, the amount of deep-seated molten matter eventually transferred by them from below might augment any subsidence due to the weight of the travelled and uplifted rock-masses. But however notable might be the depressions caused by mountain-building and volcanic accumulation, the deeps of the Pacific borders are nevertheless far too extensive and profound to be thus accounted for.

A stronger argument against the validity of Suess's theory remains to be stated. That theory impresses one at first sight as plausible and logically consistent. All the foredeeps of the Western Pacific undoubtedly lie immediately in front of folded ranges—there is no exception to the rule. Were attention confined to the Asiatic side of the ocean, or did coastal deeps occur nowhere else, we might feel justified in looking upon such depressions as one of the normal accompaniments of mountain-ranges. Unfortunately for the theory, however, deeps of precisely the same character as those of the Western Pacific are strongly developed along the west coast of South America, where, according to Suess, their presence is quite inexplicable. The mighty ranges of the Andes, it must be remembered, are all folded and overthrust towards the east—along the whole extent of coast the crustal movement has been directed from the oceanic basin against the continental plateau. The troughs that follow the coastline, therefore, are not *foredeeps* but *backdeeps*. And yet, as the charts show, these backdeeps are in all respects similar to the foredeeps of the Western Pacific. Surely a theory that professes to explain the Asiatic troughs but does not account for their South American counterparts must be considered unsatisfactory.

Careful scrutiny of the evidence has led me to the conclusion that all the coastal troughs of the Pacific without exception are of the same age and origin. They came into existence, as I believe, at a relatively recent date, and may well have been increasing in depth up to the present. The uplifts that practically girdle the Pacific are of Tertiary

age—the coastal ranges, at least, do not date further back. Certain uplifts may have commenced somewhat earlier than others, but from a broad point of view they may all be considered contemporaneous—for the grand crustal movement to which they owe their origin was general, affecting the whole east and west borders of the Pacific throughout a long period of time. The thrust from the side of Asia was pronounced, resulting, as we have seen, in the formation of the great island-arc. That thrust came from north-west and west. Along the Melanesian border of the continental plateau, however, the crustal movement was directed towards north-east, but it is not quite clear whether that movement took place in late Tertiary times or somewhat earlier. And the same may be said of the Tonga-Kermadec-New Zealand "range," the folding of which indicates a thrust towards the east. From Patagonia up to and beyond California all the coastal uplifts bear witness to a powerful easterly thrust having occurred in late Tertiary times. Thus one may say that the latest unilateral movement within the Pacific area has been from north-west and west to south-east and east—that is, on the Asiatic side, away from the continental plateau towards the oceanic basin; on the American side, from the oceanic basin against the margin of the continental plateau.

The geology of the great chain of the Andes is still very imperfectly known, but all the ascertained facts conspire to assure us that the formation of the mountains commenced long before the Tertiary era—in Mesozoic or even earlier times. The process of mountain-building was interrupted now and again by prolonged intervals of repose. This polygenetic chain measures some 250 to 550 miles across, and is of the same type as the Alps and similar folded mountains, consisting as it does of a complex of convoluted strata and translated rock-sheets of great extent and thickness. According to Professor Heim the area presently occupied by the European Alps, which are not more than 150 kilometres in breadth, formerly existed as a flat land, probably measuring 600 to 1200 kilometres across. Now, if the Andes have resulted from compression in a like degree, it is obvious that a very considerable strip of ocean-floor (probably more than 100 miles wide) must have been buckled up and added to South America.

The southern extensions of the Rocky Mountains and the Californian ranges tell a like tale of long-continued mountain-building, extending from Mesozoic down to late Tertiary times—the crustal thrust having been directed as in the case of the Andes persistently from the west. Thus, along the eastern borders of the Pacific we have evidence of a considerable diminution in the width of the oceanic basin.

Comparing the American ranges with the corresponding arcs of eastern Asia we note certain broad contrasts. The latter are neither so lofty nor so closely packed as the former. A more or less broad space separates one concentric arc from another. For instance, the youngest prominent arc—that of the island-festoons—is divided from the chains lying to the west by the epicontinental seas of Ochotsk, Japan, and China. On the American side of the ocean, on the other hand, all the

compression has been concentrated within a comparatively narrow zone along the margin of the continental plateau.

The formation of all these chains, Asiatic and American, carried on through a vast period of time, would necessarily relieve the crust within the oceanic basin and thus facilitate the sinking of the sea-floor. It is not surprising therefore that after the latest considerable uplifts of Tertiary times, a general movement of depression should have set in. The subsidence of the crust in the oceanic basin would induce strain and tension along the borders of the stiffened or relatively rigid continental plateau. In some places this might result in merely bending down the margin of the latter without producing any considerable fracturing of the crust. In other regions, however, where the crust had been thickened and rendered more rigid by compression, the strain and tension caused by the sagging of the sea-floor would be relieved by faulting. Strongly marked dislocations might therefore be expected to take place in front of the newly-formed Asiatic arcs and along the borders of the stiffened continental plateau on the opposite side of the ocean. This, I am inclined to think, is the origin of the great deeps of the Pacific. The nature of the dislocations can of course only be conjectured. The descent from the coast to the bottom of a trough, although relatively rapid, does not suggest an ordinary or normal fault—the declivity is not steep enough to be described as a cliff. No doubt the troughs, as shown upon the map and accompanying sections, appear to be quite close to the shore and to have vertical or nearly vertical sides. But that is owing to the small size of the map and to the fact that the vertical scale of the sections is greatly in excess of the horizontal scale. In reality the deepest part of a trough is sometimes eighty miles or more beyond the coastline. When drawn upon a true scale, therefore, the deeps no longer appear as vertical-sided troughs. The descent from the land to the bottom of a trough, although relatively steep, is not such as to indicate the presence of a normal fault, but rather of a series or succession of step-faults. The rise of the sea-floor from the trough to its outer border is usually at a much lower angle than the descent from the land, and the deepest part of the depression, therefore, lies much further from its outer border than from the coastline.

A glance at the map shows that "deeps" of all kinds are more abundantly developed in the Asiatic than in the American section of the Pacific; and the same holds largely true as to the distribution of islets outside of the true continental plateau—most of which pertain rather to the Asiatic and Australian than to the American side of the ocean.

When an area so extensive as the Pacific basin began to subside between rigid or practically immobile borders it would hardly do so with perfect regularity. Subsidence would result in warping the sea-floor, and so producing broad undulations and depressions. Such would seem to be the origin of the central deeps which sink from 3600 to 8400 feet, or more than one mile and a half, below the average level of the ocean bottom. (See Map, Fig. 3.) This unequal sagging or

folding of the crust must have tended to diminish the width of the upper crustal layers, and may therefore have had some influence in the formation or modification of the coastal troughs. Probably also the strain and tension caused by unequal sagging would result in rents and fractures of the sea-floor, up through which molten matter would escape, and thus give birth to the chains and groups of volcanoes which now form the numerous islets of Oceania. But why crustal mobility and subcrustal activity should have been more pronounced in the western than in the eastern section of the basin can only be conjectured. Possibly the relative degree of depression within the two areas may have had something to do with the phenomena—especially with the distribution of volcanoes. I have given 2400 fathoms as the average depth of the ocean, and there are few parts in the western section which are of less depth, except near islands. In the American section, on the other hand, extensive areas do not much exceed 1500 fathoms in depth. On the whole, therefore, the Asiatic section is the deeper of the two.

Apart from the evidence of dislocation supplied by the coastal deeps, the soundings round the margin of the Pacific basin are almost everywhere suggestive of faulting—the whole ocean floor seems to be subsiding between engirdling dislocations. The descent from the coast is in many cases so abrupt that the declivity would seem to indicate the presence of normal faults. In other tracts, however, the descent is less sudden and suggestive rather of step-faults, or possibly of simple down-bending or monoclinal folding. It is interesting to note that many years ago Richthofen expressed the opinion[1] that the Pacific basin was bounded by great step-faults, but I am not aware that he ever set forth the facts that led him to that conclusion.

We do not know how thick the crust is, and can only conjecture what the nature of the subcrustal materials may be. Not improbably, as many geologists suppose, the crust passes downwards into a viscous, semifluid, or fluid magma. If such conditions obtain, then the pressure exerted by the subsiding crust might be expected to force the mobile magma aside. It should be squeezed outwards underneath the uplifts forming the marginal zone of the continental plateau, and there it will escape from pressure by rising into the more or less vertical fissures by which all uplifts of the kind are traversed. Not unlikely, this may be the reason why volcanoes are so abundantly distributed along the mountains that girdle the Pacific. The molten matter is simply forced upwards by the subsiding crust. The supposed subcrustal conditions would also serve to explain why volcanic action should not be developed in the coastal deeps, for the walls of the faults leading down from those troughs must at great depths be kept in such close apposition as to prevent the escape of molten matter to the surface.

I have referred to these large marginal dislocations as if they were alone. It is highly probable, however, that the ocean-floor is traversed by many others. Judging by what we know of the large faults traced

[1] *Führer für Forschungsreisende* (1886); Neudruck, 1901, p. 594.

in our own and other countries, it is likely enough that the marginal dislocations that divide the oceanic basin from the continental plateau are accompanied at less or greater distances by numerous smaller parallel faults along which movement may take place in the same way as along the major dislocations. It is doubtless movements of the kind that are the cause of the many destructive earthquakes which so frequently visit the coast-lands of South America—most of these earthquakes apparently originating under the sea.

I have referred to the broad deeps distributed chiefly over the central part of the Pacific basin as being the result of the irregular settling down or sagging of the crust. Possibly also internal compression, caused by irregular movements of the kind, may have been relieved by local uplifting, and the formation of occasional wrinkles or ridges, some of which may have reached considerable heights above the average level of the sea-floor. The fact that some of the islets of Oceania give evidence of recent elevation would thus seem to show that wrinkling and up-swelling of the crust may occur here and there within an extensive area undergoing depression.

Some geologists imagine that an ancient continent lies drowned in the Pacific—a notion in support of which no evidence can be cited. It is nothing more than a conjecture, suggested apparently by the exigencies of a certain theory. According to that theory the sediments of Mesozoic and Cainozoic times have been accumulated in immensely elongated geosynclinal troughs, one of which is represented as having circled round the Asiatic and American borders of the Pacific area, so as to catch the waste-products washed down from a visionary central continent. Although it is not possible to demonstrate that the Pacific Ocean is of primeval antiquity, yet all the phenomena seem to favour that conclusion and to negative the idea of a great Pacific continent such as the geosynclinal theory desiderates. The configuration of the sea-floor, so far as soundings reveal it, is not that of a land-surface. The long coral-crowned ridges that here and there traverse the basin can hardly be other than volcanic, formed in the same way as the elongated ridge of the Sandwich Islands is forming now. The solitary islets and irregular groups of islets are all similarly suggestive of a volcanic origin.

While admitting that the islets in question are most probably volcanic, certain geologists think they may rise from the backs or shoulders of great mountain-uplifts. This view has obviously been suggested by the well-known fact that all round the Pacific basin volcanoes occur only among the encircling cordilleras. But in other regions, it need hardly be said, volcanoes are not always perched upon the backs of mountain-uplifts. Etna and Vesusius began their eruptions on the sea-floor, and there are numerous examples of recent submarine volcanoes, some of which have remained below water, while others have become subaerial. All considerable volcanoes have originated on lines of fracture, either within a sinking area or in the adjacent rigid or relatively immobile tract, usually near but sometimes much further away from the borders of the subsidence. It is not the configuration of

the surface—which may be mountainous and lofty, or low lying and plain-like—but the presence of suitable lines of fracture that determines the appearance of volcanoes within or immediately outside of a sinking area. As no trace of Palaeozoic or Archaean rocks has been detected in any of the islets within the true oceanic basin—the only rocks visible being either of organic or volcanic origin—it seems reasonable to conclude that these islets represent the tops of volcanoes and volcanic ridges which have been built up from the floor of the ocean upon lines of fracture. There is nothing in their arrangement, or want of arrangement, at all events, that militates against that conclusion. One might well expect, indeed, that a broad expanse like that of the Pacific basin should here and there be rent and fissured while it subsided, and that molten matter should rise through such fissures, and build up in time sporadic, isolated volcanic mountains, or lines of volcanic islands like those of Hawaii.

The flatness of the sea-floor may be original, but it may well be also to some extent the result of sedimentation. In early geological ages the oceanic basin probably attained no such profound depth as at present, and under those conditions currents must have played a more important rôle as carriers and distributors of sediment. It is conceivable, therefore, that even the central parts of the Pacific may be paved with Palaeozoic sediments, while Mesozoic and Cainozoic deposits may extend far outwards from the borders of the continental plateau.

While considering the great deeps of the Pacific, it is hardly possible to avoid a brief reference to those of the Indian Ocean. The eastern coasts of that ocean are undoubtedly of the Pacific type and troughs, seemingly of the same character as those of Eastern Asia, skirt the coasts of Java and Sumatra. All the appearances, in short, indicate that a movement of depression similar to that of the Pacific is in progress in the region referred to.

Having endeavoured to show that "foredeeps" are not a characteristic accompaniment of folded ranges, notwithstanding their appearance in front of the Asiatic island-arcs in the Pacific and Indian Oceans, I should like to point out that "backdeeps" occur even more frequently in connection with folded ranges. It would seem as if a period of crustal compression was not infrequently followed by partial crustal collapse. Witness, for instance, the long string of epicontinental waters lying behind the latest uplifts of the Asiatic arcs from Bering Sea south to the East Indian Archipelago. Consider also the similar depressions met with in other regions of recent mountain-uplift, such as those of the Caribbean Sea and the Mediterranean. I might even point to the broad valley of the Po, and the extensive Hungarian plains, as not improbably concealing backdeeps of a more pronounced depth than any foredeeps that may possibly lie below the young Tertiary deposits spread out in front of the Alps and the Carpathians.

The results of this discussion may be summed up as follows:—The latest uplifts on the borders of the Pacific bear witness to the close of a prolonged period of crustal compression, which was followed, as in many similar but less important cases, by a movement of subsidence that

appears to have affected the whole of the intermediate basin. It was during this movement—a movement probably still in progress—that the remarkable marginal deeps on both sides of the great ocean came into existence.

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## KAYAKS OF THE NORTH SEA.

By David MacRitchie.

(*With Illustrations.*)

It is now thirty years or thereabouts since the attention of the reading public was first drawn to a curious double series of statements, bearing upon a people known as "Finnmen," or "Finnfolk," who haunted the Orkney and Shetland Islands about the close of the seventeenth century. Each series was at first known independently of the other. It was reserved for Mr. John R. Tudor to point out, in his very interesting book on *The Orkneys and Shetland* (London, 1883), that both series appeared to relate to one condition of things. The acceptance of this conjecture as a positive fact must inevitably lead to a revision of many current notions relating to the ethnology of North-Western Europe. The question is still in abeyance, but more than one discovery of very recent date, tending to confirm the deduction propounded by Tudor, makes it of importance that the statements considered by him should be now recapitulated. To many readers of these pages they will have the charm of novelty.

The facts, then, are these. Towards the close of the seventeenth century, if not at earlier dates, the Orkney Islands were occasionally visited by a race of people called Finnmen, who came in light skin canoes identical in shape with the "kayaks" used at the present day by the Eskimos of Greenland and North America, and by the kindred Chukches and Koryaks of North-Eastern Asia. This information is obtained, in the first place, from the Rev. James Wallace, who was minister of Kirkwall, Orkney, from 1672 to 1688, the year of his death. He states generally that "these men which are called Finnmen" are "sometime" seen in Orkney waters, and he specifies two instances, one in 1682 and another in 1684, when a Finnman was seen off the islands of Eday and Westray respectively. He speaks of the visitor of 1684 as "another" Finnman, but it is possible that both instances relate to one individual. However, his first statement gives the impression that several members of the same race were then known as visitors of the Orkney Islands. He adds the information that "one of their boats, sent from Orkney to Edinburgh, is in the Physicians' Hall [Edinburgh], with the oar and the dart he makes use of for killing fish." From another source we learn that "the shirt of the barbarous man that was in the boat," by which is indicated the waterproof garment necessary to a kayak-man, was also sent to Edinburgh. The source whence this

detail is obtained is the Minute-Book of the Edinburgh College of Physicians, which records, in 1696, the transference of the canoe into the custody of Edinburgh University. It had thus been in the Physicians' Hall for at least eight years, for Wallace, who first speaks of it, died in September 1688.

Wallace's book,[1] from which the above statements are taken, was brought out in 1693 by his son James Wallace, M.D., Fellow of the Royal Society of London, who makes the additional statement :— "there is another of their boats in the church of Burray, in Orkney." This supplementary item does not appear in the edition of 1693, but in a second edition brought out by Dr. Wallace in 1700, under the auspices of Jacob Tonson, London. It is from Dr. Wallace, also, that we get a precise description of the nature of a Finnman's boat, which leaves no doubt whatever that it was essentially the same as the "kayak" of the modern Eskimo, Chukch, and Koryak.

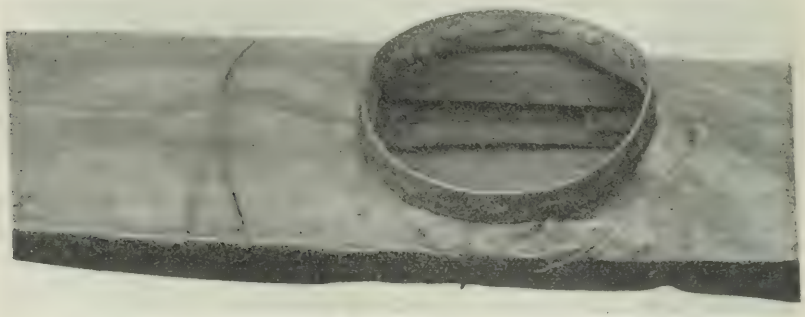
It is plain, however, that the Wallaces were in the dark as to the place of origin of the Finnmen. The father assumes that they were Eskimos from Davis Straits, and he refers the reader to the account of these people given by Louis de Poincy in his history of the Antilles (Rotterdam, 1658 and 1681). Dr. Wallace does not question the correctness of his father's deduction, but he remarks : "I must acknowledge it seems a little unaccountable how these Finnmen should come on this coast." It is rather odd to find that, in his edition of 1700, Dr. Wallace speaks of the Davis Straits Eskimos as "Finnmen." "A full account of these Finnmen may be had," he informs us, in De Poincy's book describing the natives of Davis Straits. Another noteworthy difference between his edition of 1693 and that of 1700 is that the latter states that "one of their boats which was catched in Orkney was sent from thence to Edinburgh." The expression "catched in Orkney" shows us that the kayak was not surrendered willingly by the "barbarous man" who owned it.

The Wallaces, then, regarded Davis Straits as the home of the Finnmen. Quite a different hypothesis is offered by the Rev. John Brand, who visited Orkney and Shetland in the early summer of 1700 as one of a Special Commission dispatched thither by the General Assembly of the Church of Scotland. Brand, who gives a very careful description—although evidently obtained at second hand—of the kayakman and his kayak, employs the term Finland-Men as an alternative for Finnmen, and assumes that they come from Finland ; "which is very strange," he observes, "that one man sitting in his little boat should come some hundreds of leagues from their own coasts, as they reckon Finland to be from Orkney." Brand states that "there are frequently Finnmen seen here [Orkney] upon the coasts, as one about a year ago [1699] on Stronsay, and another within these few months on Westray, a gentleman with many others in the isle looking on him nigh to the shore, but when any endeavour to apprehend them, they flee away most swiftly." As Brand further pictures the Finnman to us as "sitting in

[1] *A Description of the Isles of Orkney*, Edinburgh, 1693 ; reprinted at Edinburgh, 1883.

the middle of his boat, with a little oar in his hand, fishing with his lines," it is clear that the latter had no very great fear of being "catched," knowing well that he could rely upon the superior celerity of his kayak over any rowing or sailing-boat. Now and then, however, by a stroke of ill-luck, he failed to make his escape.

Many students of Orkney history have long been familiar with the data just given. The facts were actually published more than two centuries ago, in Wallace's and Brand's *Descriptions*. But these books, probably little read in their early editions, appear to have been almost forgotten until 1883, when they were reprinted by William Brown, publisher and bookseller in Edinburgh. In the same year Tudor's *Orkneys and Shetland*, with its accounts of the Finnmen, made its appearance. Some years later the matter was further discussed by



Aberdeen kayak. Enlargement of man-hole where occupant sits.

*N.B.*—The wooden girth, the hempen rope attaching it, and the three pieces of wood inside, with iron nails, were all added in 1900, in order to strengthen the kayak.

myself, through various channels. It was not until August 1911, however, that I obtained an item of information which supplements in a striking way the statements of the two Wallaces and Brand. Until then I had been ignorant of the fact that the Anthropological Museum of Marischal College, Aberdeen, contains a kayak having a history similar to that of the kayaks preserved in Burray, Orkney, and in the Edinburgh Physicians' Hall, about the close of the seventeenth century.[1] A detailed description of the Aberdeen kayak would be out of place here, but it may be briefly recorded that it is eighteen feet long by eighteen and a half inches broad, at the broadest part, and that it weighs thirty-four pounds. With it are the paddle and weapons of the kayak-man, which are tipped with bone, one spear having also an iron point. The history of this kayak is, that it was brought into Aberdeen, along with its owner, about the beginning of the eighteenth century, the capture having been made in the North Sea, not far from Aberdeen. The earliest printed mention of this event is found in a book published at

[1] I am indebted to Professor Robert W. Reid, M.D., Aberdeen University, for information and illustrations relating to this kayak.—D. M'R.

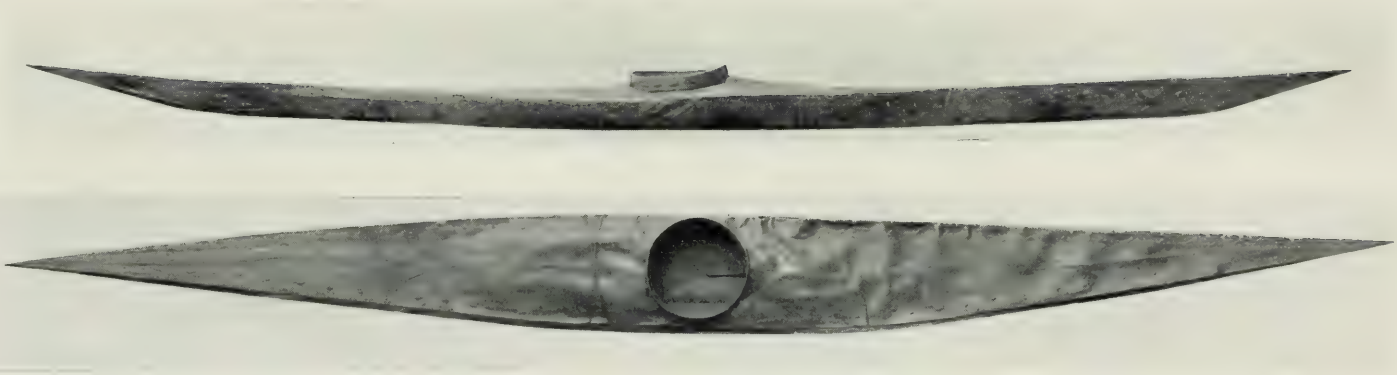


Fig. 1.—Kayak taken in North Sea about 1700. In Marischal College, Aberdeen. Profile and Bird's-Eye View.

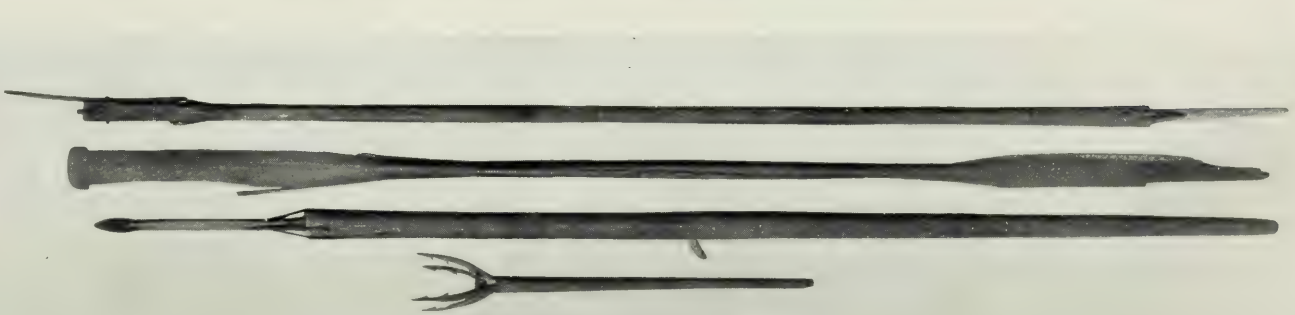


Fig. 2.—Implements found in Aberdeen Kayak, viz., harpoon, double-bladed paddle, spear, and upper portion of bird-spear.

Fig. 3.—Throwing-stick (on a larger scale than the other implements).

Paisley in 1782, entitled *A General Description of the East Coast of Scotland*. The author, Francis Douglas, had seen the kayak at Marischal College, and he refers to it as—"a canoe taken at sea, with an Indian man in it, about the beginning of this century. He was brought alive to Aberdeen, but died soon after his arrival, and could give no account of himself. He is supposed to have come from the Labradore coast, and to have lost his way at sea." It is not clear whether this hypothesis synchronised with the arrival of the captive in Aberdeen, or whether it arose in the middle or latter part of the eighteenth century. The term "an Indian man" strikes one at first as somewhat puzzling. But "Indian" was employed in a rather loose fashion at that period. As the "Indian" in question was believed to have come from Labrador, and was certainly a kayak-man, it is evident that Douglas really meant "Eskimo" rather than "Indian." The Edinburgh physicians of 1696 simply styled their kayak-man a "barbarous man." There can be no doubt that "Indian" meant much the same thing. Douglas's other statements give rise to conjecture. He leaves us in the dark as to whether the man's inability to give an account of himself was due to his ignorance of the language of his captors, or was the result of his enfeebled condition. It may be surmised that he had only been taken after a struggle, in which he was mortally wounded, and so rendered incapable of coherent speech.

We have now before our mental vision three separate kayaks or skin-canoes, all captured in British waters about the close of the seventeenth century or the dawn of the eighteenth. As to their provenance there is a considerable difference of opinion. The Wallaces, father and son, believed that they came from Davis Straits: Brand thought from Finland. Francis Douglas, or some of his contemporaries in Aberdeen, supposed that the "Indian man" had come from Labrador. This last supposition can be summarily dismissed, if it implies that a Labrador Eskimo paddled due east to Scotland across two thousand miles of ocean. Even if he had made the voyage voluntarily—a most improbable thing—the mere question of drinking-water furnishes an insurmountable obstacle. The Davis Straits theory is a trifle more plausible. Here, again, it would be necessary to assume that the voyager had prepared for his desperate adventure by taking in a large supply of fresh water. Still, if a Davis Straits Eskimo was bent upon travelling to Orkney in his kayak, it is within the bounds of possibility that he could do so, *via* Iceland, the Faroes, and Shetland. That he and his friends should do so, and should fish in Orkney waters, off and on, during a period of twenty years, is a remarkable assumption. And if the thing could be done in the seventeenth century it could have been done, and probably was done, during previous centuries. This admission leads us to the deduction that Europe must have been discovered from America, and in a far more daring fashion than anything ever dreamt of by Columbus or the early Norsemen. Columbus has achieved fame by crossing the Atlantic from Europe in a well found ship that accommodated fifty men. What is that compared to the marvellous feat of making the voyage in a little skin canoe, eighteen feet in length and weighing thirty-four

pounds! But that this feat was ever really accomplished, or, if once accomplished, repeated again and again, is a conclusion that common sense rejects. After a careful consideration of all the circumstances of the case, it becomes evident that the home of the Finnmen must be sought, not in Greenland or Labrador, but in Europe.

It will be remembered that the Rev. John Brand, writing in 1700, pronounced the home of the Finnmen to be Finland. He certainly thought it "very strange" that they should come all the way from Finland to Orkney, and "wonderful" that they should be able to keep the sea so long. However strange and wonderful, it would not be an impossible thing to do. Admitting that there were then kayak-people in Finland, and that they had no enemies to molest them as they came down the Baltic and through the Danish Sound, such people could undoubtedly make their way to the north of Scotland, keeping generally to the coast, and fishing at times as they went along. One of the trips suggested by Macgregor as suitable for one of his "Rob Roy" canoes (which are clumsy, wooden adaptations of the kayak) was from Stockholm to St. Petersburg. If that voyage could be performed in a Rob Roy canoe, certainly it could be done in a kayak, and the tour might be extended to several times the original length. There still remains the question of motive. There is no obvious reason why a seventeenth-century Finlander should want to make such a long and tedious voyage. There is also the further consideration that there may not have been any kayak-using people in Finland at that period.

Such a population did exist, however, in the extreme north-east of Russia between Vaigatz and the mouth of the River Petchora. We know this partly from the English navigator Stephen Burrough, who visited the island of Vaigatz in 1556. In describing the manners of the local Samoyeds, Burrough observes (*Hakluyt*, 1st ed., p. 318):—"Their boats are made of deers' skins, and when they come on shore they carry their boats with them upon their backs." Although that is also the practice of existing Eskimos with their kayaks, Burrough's reference is not explicit enough to show that these skin boats were actually kayaks. A century later, however, we get a definite statement from Martinière, who visited the same region in 1653, as one of a Danish expedition. His first reference to the native canoe is suggestive, although, as in Burrough's case, it also is indefinite. "We had not long quitted our ships," says Martinière, speaking of an expedition in the ships' boats, "when we saw a native in his canoe, about half a league from land. As soon as he saw us coming towards him, he rowed [or paddled] with such force that it was impossible for us to get near him. And, on reaching the shore, he, with great swiftness and dexterity, lifted his canoe upon one shoulder, and, holding his bow and his spear in the other hand—his quiver being on his back—he sped away." From the fact that he was a mile and a half from land when first sighted, that he easily out-distanced the ships' boats, and that he lifted his canoe on his back in the fashion described by Burrough a century earlier, it might be reasonably inferred that the craft in question was a skin kayak. Nevertheless, the description is still not definite enough. Martinière's

next reference is, however, quite explicit. He relates how, as he and his comrades were returning to their ships in the boats, four in number, they encountered another native canoe in the open sea. By skilful manœuvring, the Danes managed to capture this canoe, with its occupants; for there were two, a man and a woman. "The canoe was made in the style of a gondola (*fait en gondolle*), being fifteen or sixteen feet long by two and a half feet broad, very cleverly constructed of fish ribs covered with fish skins stitched together, thus making the canoe a purse, as it were, from one end to the other. Within it the two were enclosed up to the waist in such a manner that not a single drop of water could get into their little vessel, so that they were enabled to expose themselves to every tempest without any danger."[1] Commenting recently

Aleutian kayaks: 18th century.

upon this passage, M. Charles Rabot observes (*La Géographie*, 15th Sept. 1911, p. 187), "This description and the dimensions correspond very exactly to those of the two-holed kayak in use about Bering's Straits. The fish-skin is certainly seal-skin; a seal, a whale, and a walrus being equally a 'fish' to Martinière." Thus, since this canoe was a two-holed kayak, the presumption is that the skin canoes referred to by Burrough were also kayaks. The use of the two-holed kayak on the coast of Russia is of much interest. It seems to be only among the Eskimos of the Aleutian islands and of the Alaskan region that this variety is known at the present day. So far as I am aware, it has not been reported among the Eastern Eskimos. Another interesting feature is that one of the two paddlers was a woman. There is no reason why a woman should not paddle a kayak: indeed, two Eskimo women at Angmagsalik in East Greenland do possess kayaks—or did some years ago. But, as a matter of fact, the kayak is almost exclusively a man's canoe, in modern times.

The above illustration is reproduced from Captain Cook's *Voyages*,

[1] An abstract of Martiniere's book will be found in *The Scottish Geographical Magazine* for August 1909, pp. 393-403.

and represents two of the varieties of kayak used in the Aleutian archipelago in the eighteenth century. The canoe containing two figures is manifestly the same as that described by Martinière as in use along the Vaigatz coast in 1653. It may be added, as drawing the parallel closer, that William Gourdon, an Englishman who wintered at Pustozera in 1614-1615, mentions that the Samoyeds there call their upper coat a *parka*. This is the word used to-day by the Alaskan Eskimos for the same garment.

From the evidence just adduced, it will be seen that there were actually kayak-using people in the north-east of Europe at the time when such people were occasionally seen in Orkney waters. But the objection of distance once more precludes the idea that the home of the Orkney Finnmen ought to be looked for in the neighbourhood of Archangel. The Samoyeds of that region might indeed have made their way by slow degrees to the Orkney Islands. But they had no inducement to do so. Obviously, they must be left out of consideration.

Nearer to Scotland, but still remote, is Lapland; and Baron von Düben tells us how the Mountain Lapps have a tradition that their forefathers crossed the Sound from Denmark in small skin-boats, during a spell of calm weather, with their reindeer swimming after them. The area occupied by the Lapps once extended far to the south of modern Lapland. Högström relates that the Lapps of his day (*c.* 1746) asserted that the whole of Sweden once belonged to their ancestors. The modern Scandinavians are admittedly a Teutonic race that intruded itself into Scandinavia in times that may fairly be called historic; killing and driving northward their Lapp precursors. "Even within the last ten years," observes Lord Avebury (*Prehistoric Times*, edition of 1900, p. 281), "a few families of Lapps might still be found in the neighbourhood of Nystuen, on the summit of the Fillefjeld, and some other places in the south of Norway, but none are now to be found on this side of the Namsen river." If any remnant of the Mountain Lapps survived along the South-Norwegian seaboard in the seventeenth century, the appearance of "Finnmen" in Orkney could be easily accounted for. This is a matter which could be decided by united research on the part of Scandinavian scholars. Indeed, Rafn seems to have led the way in his great work, *Antiquitates Americanæ*, published at Copenhagen in 1837: for there, in referring to the skin-canoes of the "Lapps" or "Skraelings" of North America—both of these terms having been applied to the Eskimos by early Norse writers—he indicates (p. 43, note *a*) that the kayak was known to Isidore of Seville in the sixth century, who describes it as "a little skiff, made out of withes united by raw hide." The Norse or Icelandic name, he adds, was *húðkeipr*. Isidore's description, however, leaves room for doubt as to whether the skin skiff in question was identical with a kayak.

It will be seen, then, that if the hypothesis be granted that one or more Lapp groups survived in South Norway in the seventeenth century, as Lord Avebury's statement seems to warrant, and if they made use of little skin boats as the Mountain Lapps allege their forefathers did, then the visits of kayak-men to Orkney could be accounted for without our

looking to such immense distances as Labrador, Greenland, or even Finland. The name "Finn" really supports the idea that those people were Lapps; because "Finn" is the Norwegian name for Lapp, and the Orkney and Shetland Islanders of to-day are mainly descended from Norwegians of the ninth century. What will appeal to some, although not to all, as a cogent argument in favour of this view, is the fact that the folk-lore of Orkney and Shetland abounds in references to those Finnmen or Finns as coming across from Norway.

As already stated, it was John R. Tudor who first recognised the apparent, and indeed the obvious connection between those traditions and the historical visits of Finnmen recorded by the two Wallaces and Brand. After quoting these writers, he goes on to ask:—"What can these Finnmen have been? Is it possible Eskimo can have been driven over from Greenland? Or can there have been a substantial basis of actual fact for the traditional Shetland Finns that 'came ow'r fa Norraway'? The Burray and Stronsay instances all point to the kayaks, or whatever they were, being driven from the east, and the ones seen off Eday and Westray may, with equal probability, have come from that quarter. Besides, Cape Farewell, the nearest point of Greenland to the Orkneys, is 1180 nautical miles from the Noup Head of Westray, whilst the Norwegian coast, at the southern end of Finmarken, is 750, and at the nearest point only 240 miles."

Considerations of space forbid that I should attempt to begin an examination of the traditions referred to by Tudor. They are of great interest, and are capable of a perfectly rational interpretation, although they are occasionally obscured by popular misconceptions.

NOTE.—Since the above was written I have been favoured with a report on the woodwork of the Aberdeen kayak and its implements, kindly furnished by Mr. William Dawson, B.Sc., Lecturer in Forestry in the University of Aberdeen. Mr. Dawson states that the wood is all of *Pinus silvestris*, a tree which is found over a considerable part of North and Middle Europe, its principal habitat being the Baltic neighbourhood. It is unknown in Greenland and North America. Mr. Dawson writes: "The wood of the spears in the Aberdeen kayak shows the character of timber grown in a continental climate, and that too in a continental climate pretty far north, or at very high elevations. The characters from which this can be deduced are (1) The extreme regularity of each season's growth, and (2) the smallness of each season's growth. . . . The wood of the spears is similar in character to some of the wood we get at the present time from Norway and Sweden, and from Finland. . . . The 'thrower' [the short stick for launching the darts shown in Fig. 3 on the plate] is of wider ringed wood, but it too is regularly grown, and might have been grown in more sheltered places in the same neighbourhood as produced the wood of the spears."

# ON THE PERSONAL CHARACTERISTICS OF GREAT EXPLORERS.[1]

By Major Leonard Darwin, Late President R.G.S.

In addressing the Royal Geographical Society in May last, when I was about to hand over my duties as President to my successor, I discussed at some little length the lines on which geographical societies might hope in the future to continue to advance in the most profitable manner. Whilst I have no intention of going over the same ground a second time, there are, it is true, one or two points concerning which I am glad to have this opportunity of making further observations. I said then that one of the functions of our geographical societies should, in my opinion, be to keep alive the knowledge of the great deeds of our fellow-countrymen in the past in the field of exploration; a duty which does not imply any limitation of their activities in other directions. I urged, moreover, that it was incumbent on them in all geographical questions to lay especial stress on all matters of direct importance to the human race; one of the advantages thus gained being that in the field of education the interests of the young are thus most easily aroused. These are the two points on which, with your permission, I should like to insist in somewhat greater detail.

The method of illustrating my meaning which occurs to me in the first place is, it is true, not connected with that science to which we owe our allegiance, and therefore needs some apology for its introduction here. The city of Lichfield—a city with which I was connected at one time in a way that I must not here even allude to—has been the birthplace and at times the home of a number of remarkable men, chief amongst them all being Samuel Johnson, the great lexicographer. Though of course all here present know by name the works for which he is famous, yet I confess I am much tempted to ascertain by a show of hands how many of my audience have actually consulted his Dictionary, except out of curiosity, and how many have read *Rasselas* and the *Lives of the Poets* from cover to cover. But, even without such a direct test, it certainly will be admitted that whilst Johnson is universally known, he is now but little read. Then how is it, it may be asked, that his fame is, as it were, so vividly impressed on the national mind? The only other name I should like to mention in connection with Lichfield is that of Erasmus Darwin, my great-grandfather. He was a contemporary of Johnson's, though, if family tradition is to be trusted, they seldom met, and when they did so, their dislike was mutual and cordial. A trivial story is told of my ancestor in connection with a defect in his speech. A young man asked him in, as he thought, an offensive manner, whether he did not find stammering very inconvenient. "No, sir," he replied, "it gives me time for reflection, and saves me from asking impertinent

[1] An Address delivered to the Society in Edinburgh on December 7, 1911.

questions." This anecdote indicates that Dr. Darwin was not without the power of saying biting things, somewhat in the style of his great contemporary; and it may also give a clue to the reasons for his sentiments towards him. Johnson always bore down his opponent in argument with a torrent of words; and, when that opponent was handicapped by a stammer, his chances of getting in a word must have been small indeed. Erasmus Darwin was a pioneer in advocating the belief in evolution; and, as a poet, he was for a time so much held in esteem that, even at a date as late as when Mr. Gladstone was at Eton, his works were held up as examples by which the style of the schoolboy should be moulded. I don't know if it be unfilial to say so, but, in my opinion, worse advice could hardly have been given. It is true that four lines of his, written before the year 1789, have been much quoted lately:—

> "Soon shall thy arm, unconquered steam, afar
> Drag the slow barge, or drive the rapid car;
> Or on wide-waving wings expanded bear
> The flying chariot through the field of air."

This verse, though it proves the writer to have been but a poor poet, certainly indicates that he possessed a remarkable mind. If these be the facts of the case, then why is it we know so much of Johnson and so little of Darwin? Even when full allowance has been made for Johnson's superiority in many respects, may we not say that the difference between the reputations of these two men to-day is to a considerable extent due to the fact that one was the friend of that great Scottish biographer Boswell, and that the other was not? It is largely because of the vivid picture painted by Boswell of Johnson, which indicates all his peculiarities as well as his merits and defects, that the names of his solid contributions to literature are now so widely known. And my first point is that, if you wish to spread abroad a knowledge of the solid contributions to geographical science made by great Scottish explorers, you must, in like manner, be not afraid to discuss the personal characteristics of these heroes of the past.

If it be agreed, as it assuredly will be, that it is a function of a national society, such as the one I am addressing, to deal in historical geography, and if, in so doing, it is fitting that the personal characteristics of the great explorers of your own nation should be dealt with in a prominent manner, it occurred to me that I might endeavour to illustrate this method of treatment by referring briefly to the lives of some of those great Scotsmen who have done famous deeds in this field in the past. It would be obviously futile to attempt to deal in this manner with all the great travellers who have set forth from these shores; and, even if this were possible, such a task would be more fitly performed by one of their own fellow-countrymen. To bring my remarks within reasonable limits, I shall, therefore, merely allude briefly, for the purposes of illustration, to the exploits of three of the Scottish travellers of the eighteenth century, men who, in consequence of the world-wide reputation they won, have in a sense made themselves international. I

shall follow no chronological order in my remarks, and I may add that one of my objects will be to prove, by the inadequacy of my comments, that here is a field on which further labour might be profitably expended.

In any attempt to discuss the characters of great explorers generally, it must at once become apparent that in their case one great quality, which I may describe as determination, is never absent, and indeed nearly always seems to overshadow all their other characteristics. No man has ever traversed a hitherto unexplored country who was not, as it were, filled to the very brim with will-power. And no finer record occurs, I believe, in all geographical history than that which is to be found in the travels of Mungo Park, of the marvels which can be accomplished by sheer determination in the way of overcoming apparently overwhelming difficulties and dangers. In discussing this great quality in connection with this great name, no better means of illustrating my meaning occurs to me than the prosaic comparison between a man and a motor-car. In judging a car, we look to its horse-power, the soundness of its works, its steering-gear, and the mechanical arrangements for shutting-off steam, if it be a steam-car. Now, just as in a motor, we may have high horse-power combined with bad works and bad mechanical arrangements of all sorts, so in a man we may find great will-power in the absence of nearly every other great quality. Indeed, where the quality of determination is highly developed, that element in a man's character which is comparable to the arrangement for shutting off steam in an engine is generally conspicuous by its absence. An individual thus endowed must keep moving; and, if his steering-gear be defective, misfortune is certain to come sooner rather than later. It is for this reason, perhaps, that the domestic lives of great men of action have often been unhappy; though, in this respect, nothing whatever can be said against the hero now under discussion.

The main object of my motor car illustration is, however, to strengthen my protest against the view that we ought to expect great men to be great in all their qualities. No one would hope to find more than one man endowed with Mungo Park's will-power in any one of our largest cities; or, in other words, we may perhaps say that he was one in ten thousand in this respect. Now take another characteristic such as organising capacity, and imagine such a standard of excellence in this quality that it would only be attained by a dozen young men in a city like Edinburgh; or, let us say, a standard of excellence of one in a thousand. If these two qualities of will-power and organising capacity were in no way correlated together—probably a somewhat inaccurate assumption—to find out the chances of a man of Mungo Park's determination, also having organising capacity up to this fairly high standard, we have to multiply 10,000 by 1000, and we thus learn that only one young man in ten million is likely to be thus highly endowed as regards both these qualities; or, in other words, that such a prodigy is not likely to appear more than once in several generations in the whole United Kingdom. Though my assumption as to the independence of these qualities probably departs somewhat from the truth, yet by this

method of regarding the matter it does become apparent that a man might well be regarded as belonging to the select band of heroes even though he did not attain to a high standard of excellence in some respects. There is, in short, no necessity to endeavour to cover up the failings of great men under a thick coating of whitewash, as is so often done.

Let us then have no hesitation in admitting that Mungo Park showed no signs of possessing very great ability. Neither was his capacity for organisation—a quality so useful to the explorer—in any way remarkable as far as can be judged from the material available. When he started in 1795 on his first expedition from the River Gambia to the Niger, his retinue consisted of one negro servant, one slave boy, one horse, and two donkeys, whilst for the greater part of the time he was almost without clothes or money, and entirely without retainers or cattle of any description. It required but little skill in organisation, at all events, to enable him to advance under these conditions! In his second expedition, in which he followed nearly the same route from the coast, and in which he lost his life, he was accompanied by a considerable number of white soldiers and sailors, with few, if any, negro carriers to aid them, a most unsuitable arrangement. Indeed, his whole method of conducting this expedition seems to indicate that his previous journey had taught him less than might have been expected. His soldiers, for example, were made to carry their red coats with them all those weary and disastrous miles. And as to his capacity for shutting off steam, to continue the use of my simile, the absence of that quality may, perhaps, merely be regarded as another aspect of his determination to advance whether it was prudent or not and whatever dangers faced him.

The only subject in connection with which Mungo Park's character has been subject to actual adverse criticism is the slave trade; though here, as it seems to me, the facts necessary to enable us to speak with complete confidence are wanting. It is certainly true that he did not specifically condemn slavery or the slave trade, and that he went so far as to assert that the effect which a discontinuance of the trade in slaves, as carried on by Europeans, would produce "on the manners of the natives" would be neither "so extensive or beneficial as many wise and worthy persons fondly expect" (*Mungo Park's Travels*, i. p. 441)—a somewhat guarded and equivocal statement. It must, however, be remembered that the gentleman to whom Mungo Park owed most for assistance rendered to him on his journeys was a slave trader: and that Mr. Edwards, who certainly helped him largely in editing his journal, and who was the secretary of the African Association, which financed and originated the expedition, was a pronounced opponent of the abolition movement. In reading that journal we are in fact apt to be annoyed at the thought that some of its pompous phrases may be attributable to the editor and not to the author, and to wish that the whole tribe of editors could be taught to see how worse than useless often are their well-meant efforts at "improving" the style, improvements which merely tend to hide the real man from the eyes of posterity. The sentence above quoted is one which may, therefore, merely indicate the limit up to which Mungo Park could be induced to go in stating his views whilst remaining

in accord with these of his slavery-advocating friends, perhaps in the hope of favours to come. In fact, with the knowledge we possess it can only be said that at the best Park sought to conceal for a time his true sentiments out of deference to the views of those to whom he owed so much ; whilst, at the worst, he can only be condemned along with thousands of his fellow-countrymen for not striving to rid the world of a curse. It is fair also to add that his telling descriptions of the horrors of the slave trade proved to be of great value to the abolitionists in their campaign for freedom.

What we have mainly to admire in Mungo Park is, therefore, his determined perseverance, a quality which showed itself almost equally on his two expeditions. To illustrate this characteristic, it is useless merely to point to the map and to dilate on the amount that he added to the geographical knowledge of his contemporaries ; we must descend for this purpose to personal details. In this connection, may I, in my capacity of President of a Eugenical Society, begin by pointing out that he came from a Scottish yeoman stock, a stock from which every element of weakness had been eliminated during many generations of hard and toilsome lives. Both as regards his body and his will-power, he seemed to belong to a different class to all who surrounded him, white or black. To realise to what extent he excelled in this quality of determination, it must be remembered how small was his retinue on his first expedition, how quickly it all vanished, how he was made prisoner long before his journey's end, and how he only escaped after weeks of suffering in circumstances which made "a cold sweat" break out on the forehead even of Mungo Park. Yet on he pushed, so bedraggled in his costume that the very slaves were ashamed to be seen in his company. At last he did attain his goal, the Niger, the first European to reach its banks, and the first to prove that it flowed eastward, and not westward, as so many then supposed. Thus far he had advanced in the face of ever-increasing difficulties and dangers, either with chance companions or marching alone, and received almost everywhere in a hostile manner ; thus he pushed on for a short way down that great stream, worn out by sickness, exhausted with hunger and fatigue, half-naked, and with no articles of value with which to buy provisions or lodgings, except a few cowries given him by a native chief ; thus he journeyed on till at last, to quote his own words, "I began to reflect seriously on my position." Began to reflect! And when at last he did turn back we feel that it was only because he dreaded, not death, but dying in Africa with his mission unaccomplished, and his records lost.

It is, however, quite impossible in a few words to give any idea of all the dangers and difficulties which Mungo Park had to face in Africa. In facing these trials, his patience was infinite whenever it was clear that his end could only thus be gained. On many occasions he was obliged from sunrise to sunset "to suffer, with an unruffled countenance, the insults of the rudest savages on earth" (*Ibid.* i. p. 189), and, even when it was merely a case of satisfying their curiosity, such a performance as "dressing and undressing, buttoning and unbuttoning from noon to night" (*Ibid.* p. 186), must have been most trying to the explorer's

temper. When the arguments in favour of inaction were not quite conclusive, his ardent temperament did, however, at times lead him astray, his most serious error of judgment being made in connection with the date of departure on his second expedition. In consequence of the dilatory action of the Home Government, when Mungo Park landed in West Africa in 1805, he had to choose between a long delay on the coast, and a march to the Niger with the probability of not completing it before the rains set in. The only known reasons which induced him to decide in favour of an immediate advance were that it was the most economical course to pursue, and that it was impossible to know how the Colonial Office, who were financing the expedition, would regard his long sojourn on the coast. Under cover of these apparently insufficient excuses, he pushed forward as soon as his cumbrous retinue of Europeans was organised, with the terrible result that only four out of the thirty-eight who started from the coast were able to accompany him on his canoe journey down the Niger, all the remainder having perished before this little band set forth to be heard of no more.

It is always easy to be wise after the event, and in this case it is more profitable to recall in connection with the tragedy of this march from the coast, not its cause, which was in large measure the unhappy selection of the date of departure, but rather the heroism with which the leader of this stricken party met all his manifold troubles. With men constantly sickening and dying, with donkeys straying and being lost, with natives constantly stealing his goods, everything seems to have depended on the indomitable will of Mungo Park, from the "coaxing on of sick soldiers" to the reloading of fallen asses, even whilst he himself was suffering from fever. But note the spirit in which after all this suffering, he wrote to the Colonial Office when about to set off down that great stream which led no one then knew whither. "My dear friend Mr. Anderson and likewise Mr. Scott are both dead; but though all the Europeans who are with me should die, and though I were myself half-dead, I would still persevere: and if I could not succeed in the object of my journey, I would at last die on the Niger" (*Ibid.* ii. p. cxxii). And his death when attacked by natives in the Bussa Rapids, after descending the river for about a thousand miles through unknown country, proves that this was no mere empty boast.

The foregoing observations have all been made with the view of illustrating Mungo Park's will-power. As regards other points in his character, it is not easy to make them stand out clearly, because of the scanty material at our command. It is true that we are told that, whilst somewhat reserved and silent, he had deep religious convictions, was an ardent lover of poetry and scenery, and was in his youth a keen student in many lines of thought. But such bald statements as these quickly escape from our memory, unless reinforced by illustrative incidents. He undoubtedly possessed an affectionate nature, a fact attested to by his inability to face the pain of parting with his wife, to whom he could only trust himself to send a written adieu. Then again, all his references to his brother-in-law, Anderson, are full of feeling.

The following incident may, perhaps, be held merely to be an instance of great personal courage, though in that respect it is certainly worth quoting. When leading the horse carrying his sick friend he tells us "he heard a noise much like the barking of a large mastiff, but ending in a hiss like the fuf of a cat." Here, by the by, we may note that this second journal is luckily unedited, and characteristic expressions have not been struck out by an all-wise editor. "We heard another bark nearer us, and presently a third still nearer, accompanied with a growl. I now suspected that some wild animal meant to attack us, but could not conjecture of what species it was likely to be. Coming to an opening in the bushes, I was not a little surprised to see three lions coming towards us. They were very large, and came bounding over the long grass, not one after another, but all abreast of each other. I was afraid, if I allowed them to come too near us, and my piece should miss fire, that we should be all devoured by them. I therefore let go the bridle and walked forwards to meet them. As soon as they were within a long shot of me, I fired at the centre one. I do not think I hit him; but they all stopt, looked at each other, and then bounded away a few paces. I was very happy to see the last of them march slowly off amongst the bushes" (*Ibid.* ii. p. 179: somewhat abridged). When Anderson died a couple of months later on, we have this entry in the journal: "At a quarter past five o'clock in the morning my dear friend, Mr. Alexander Anderson, died after a sickness of four months. I feel much inclined to speak of his merits; but as his worth was known only to a few friends, I will rather cherish his memory in silence, and imitate his cool and steady conduct, than weary my friends with a panegyric in which they cannot be supposed to join. I shall only observe that no event which took place during the journey ever threw the smallest gloom over my mind, till I laid Mr. Anderson in his grave. I then felt myself as if left a second time lonely and friendless amidst the wilds of Africa" (*Ibid.* ii. p. 222). It cannot be doubted that Mungo Park had felt keenly the deaths of his other comrades, and these words, probably written on the spur of the moment, must only be held to mean that all his previous misfortunes were as nothing to him compared with the loss of this friend.

Finally, one other good quality which this explorer possessed in a high degree, a quality of the highest importance to the traveller in Africa, must be briefly alluded to; and this was his power of making friends of all he met with. He tells us that it afforded him "peculiar pleasure" to remember that in his second march to the Niger he had always been able to preserve the most friendly relations with the natives. His deep indignation when, on his first expedition, he was robbed of his slave boy, and the personal sorrow which this companion in his troubles showed on that occasion also illustrate this point. One other incident may be quoted, one of the several occasions on which he received help from women, help which certainly saved his life. So hostile were the inhabitants of the district he was traversing, that he was contemplating spending the night in the branches of a tree, with heavy rain threatening, when a woman came up to him, and perceiving

how weary and dejected he was, led him to her hut and gave him food. There he was allowed to lie down to sleep, whilst the women resumed their task of cotton-spinning. And, as they toiled, one of the youngest sang an improvised song, the rest joining in a sort of chorus. The words ran thus:—"The winds roared, and the rains fell. The poor white man, faint and weary, came and sat under our tree. He has no mother to bring him milk: no wife to grind his corn," with a chorus "Let us pity the white man, no mother has he" (*Ibid.* i. p. 296). No wonder in the circumstances that the traveller was affected "in the highest degree."

Other incidents, such as those connected with his friendship with Sir Walter Scott, might well here be included. But enough has been said to prove that Mungo Park was a man to be loved as well as admired. Let me add that a monument is about to be erected at the mouth of the Niger to commemorate the great deeds of Park and of Lander in first tracing the course of that great stream from its upland waters to the sea, a tribute to the memory of their heroic fellow-countryman at which every Scotsman will rejoice. It was partly on this account that it seemed suitable to make him to-night the most prominent figure amongst the eighteenth-century explorers.

Amongst the other great Scottish explorers of the eighteenth century, whose characters are worth studying in order to more forcibly impress their deeds on our minds, James Bruce unquestionably stands first, a traveller who visited many countries, but one whose fame should mainly rest on his work in connection with the history and geography of Abyssinia. It is true that the Portuguese Jesuits had traversed that land more than two centuries before him—indeed the great Dr. Johnson had translated the early seventeenth-century voyages in Abyssinia of Father Lobo—but the country was very dangerous to visit, and the difficulty of the task which Bruce performed will be realised when it is remembered that no one succeeded in penetrating far into the interior until thirty years after he left it. Considering the date at which he travelled, the efforts which he made to plot his route on the map with scientific accuracy, and to record with care his meteorological observations, are deserving of high praise.

Here, however, we are concerned with his character rather than with his deeds. And, in passing from Mungo Park to Bruce, one cannot but be struck at the striking contrast presented by these two men in many respects. Both were, it is true, endowed in the highest degree with that prime requisite for the explorer, personal courage; though I doubt if Bruce had quite the same spirit of absolutely dogged and determined perseverance that animated Mungo Park. Both also were possessed with restless energy, Bruce never being idle in his mind in youth and middle age, and remaining active in his body till death. Like Mungo Park, he was ardent in his affections, and his home was a happy one, at all events till death robbed him of his second wife. Again, both these great men, we note with regret, are said to have been opposed to the abolition of slavery. But here our list of similarities ends.

If, in the first place, we look to the environment, to use the popular

phrase of the day, of these travellers, we see that Bruce had in this respect many relative advantages. He was educated at an English public school, Harrow, and at a Scottish university, Edinburgh, and appears to have made fairly good use of his time, though much of the learning which proved to be most practically useful to him was acquired subsequently. Long after his education was nominally completed, he continued to study drawing, astronomy, and languages, about a dozen tongues being said to be known to him, though how profoundly known is somewhat doubtful. His was, indeed, the kind of mind which led him to be somewhat easily convinced as to the soundness of his own knowledge, and therefore tempted him to theorise with insufficient thought or data; a mind, in my opinion, far more to be admired than that of the thousands of those who never theorise at all. It is not surprising, therefore, that many projects, civil and military, passed through his mind before he entered Abyssinia to collect the materials for his really great work on that country, that event taking place when he was thirty-nine years old, in the year 1769, or two years before Mungo Park was born. Then again, Bruce was comparatively rich even when young, for he early received a "respectable patrimony" from his father, coal subsequently being found on the ancestral domain; and he endeavoured to add to his inheritance by entering the wine trade. Indeed, one of the faults of our hero's character may have been a somewhat undue appreciation of the importance of his position, for not only did he "reverence ancestry and noble descent," but he also loved display. His personal dignity and his stately deportment—"he was the tallest man you ever saw gratis," Fanny Burney tells us—were, however, in all probability well calculated to produce a favourable impression on the half-wild aristocrats with whom he had to deal at the Abyssinian court. His temper is said to have been hasty and somewhat suspicious, faults which led him to fight one duel in which he nearly killed his man, and to travel to Rome from afar in the hope of fighting another. But one cannot but feel, as the saying is, that many of his faults were on the surface, and that, in most respects, he possessed a nature which was both honourable and lovable. Certainly he was a cheerful and easy companion, very successful in society of all sorts, and greatly impressing those he met with a belief in his ability, as is proved by the interviews he had with several great statesmen—Lord Chatham amongst the number—before he had made any name for himself.

In travelling in a semi-civilised country like Abyssinia, success largely depends on what may be described as the diplomacy of travel, an art in which Bruce showed the greatest proficiency. He always took great pains to secure letters of recommendation of every kind that might prove useful to him. He adopted many methods of ingratiating himself with all classes of society in the countries he visited. His long residence among the Arabs had given him, he tells us, "more than ordinary facility in managing the horse," and that proficiency in the presence of a nation of bad horsemen gave him an "evident superiority." Moreover, to quote his own words, "being in the prime of life, of no ungracious figure, having an accidental knack, which is not a trifle, of

putting on the dress, and speaking the language easily and gracefully, I cultivated with the utmost assiduity the friendship of the fair sex, by the most modest, respectful, distant attendance and obsequiousness in public, abating just as much of that in private as suited their humour and inclinations" (*Bruce's Travels*, i. p. lxxii.). That he abated a good deal of his obsequiousness, even in public, on certain occasions is indicated by an anecdote he tells concerning marketing on the march. Three native beauties, having entertained him greatly in conversation, he made them "a present of a few beads, and asked them how many kisses they would give for each? They answered very readily, with one accord, 'Pah! we don't sell kisses in this country: who would buy them? We will give you as many as you want for nothing'" (*Ibid.* iii. p. 110). His skill in the use of firearms was also advantageous to him, his double-barrelled gun being a wonder to all beholders. Lastly, he took lessons in medicine from two doctors in the East, with the definite object of facilitating his further explorations, and acquired a skill and knowledge which was to his own complete satisfaction at all events. "Thus instructed," again to quote his own words, "I flatter myself, no offence I hope, I did not occasion a greater mortality among the Mohometans and Pagans abroad than may be attributed to some of my brother-physicians among their fellow-Christians at home" (*Ibid.* i. p. xvii). Whether he would have been acknowledged as a brother-physician at home is doubtful: but his advice on medical matters was, as far as a layman can judge, both sensible and sound, and possibly in some matters in advance of his age. At all events, it is not fanciful to attribute to his treatment of some of the members of the royal family for small-pox the fact that he ever managed to leave the country alive. When once he had been appointed gentleman of the king's bedchamber, in consequence of these services, his difficulties diminished considerably, though they by no means disappeared. It should be noted that he never accepted fees, even from the highest in the land, thus producing a great impression of his social position at home.

Thus we see that our hero was at times somewhat of an actor, and also that it is not always quite easy to detect when he intends to introduce an element of humour into his narrative. All this should be borne in mind when reading his account of what he himself probably considered the greatest achievement of his life, that is, his so-called discovery of the source of the Nile. It is not surprising that a superstition then existed that one particular little streamlet could be definitely labelled as the source of a river, a streamlet which threw peculiar lustre on its discoverer, whilst all the myriad of other little water-courses, each of which contributed equally to the total volume of water reaching the ocean, might, as it were, be treated with comparative contempt; it is not surprising that this superstition then existed, seeing that it has retained its full potency even to the present day in the minds of many travellers. But, whether Bruce did discover this source or not—it had as a fact almost certainly been visited by the Portuguese a century and a-half previously—he can hardly be blamed, in the then existing state of geographical knowledge, for not knowing that other sources of the Nile

existed nearly a thousand miles further from its mouth than the wells which it gave him so much satisfaction to visit. Whether his satisfaction was excessive or not may perhaps best be judged by a reference to his own words. Here is how he described the sensations he had felt on that occasion: "It is easier to guess than describe the situation of my mind at that moment—standing in that spot which had baffled the genius, industry and inquiry of both ancients and moderns, for the course of near three thousand years. . . . Fame, riches and honours had been held out for a series of ages to every individual of those myriads these princes commanded, without having produced one man capable of gratifying the curiosity of his sovereign, or wiping off this stain upon the enterprise and abilities of mankind, or adding this desideratum for the encouragement of geography." Though "a mere private Briton" he triumphed there, he tells us, over kings and armies (*Ibid.* iii. p. 597). These thoughts were leading him "nearer and nearer to presumption," when he found his mind turning to all the difficulties ahead of him, and causing him a deep despondency, "blasting the crown of laurels" he "had too rashly woven" for himself. And when, in order to divert his mind, he proceeded to drink the healths of many of the crowned heads of Europe in that sacred water in a very theatrical manner, buffoonery and his unquestionable loyalty to his sovereign were mingled together in a very queer way. In short, as this discovery did nothing towards elucidating the hydrography of this great river system, perhaps the less said about it the better for Bruce's reputation.

On his return to England, Bruce was no doubt accused of telling travellers' tales, more especially with reference to the eating of raw meat by the Abyssinians. We hear from Macaulay how "Bruce, who had washed down steaks cut from living oxen with water from the fountains of the Nile, came to swagger and talk about his travels"; and it is indeed certain from other sources that he made several avowed enemies by his self-assertiveness. He did not publish his travels until sixteen years after his return to Europe, the delay being accounted for by ill-health and certain lawsuits he became involved in because of his long absence; and the absence of any written statement added force to the slanders of those trying to injure him. The value of these attacks may, however, perhaps be sufficiently gauged by the fact that one of the main accusations made against him was that he had never been in Abyssinia at all! My own impression is that he always intended to tell the truth; but that before the publication of his travels, he had frequently narrated in an animated manner many of the anecdotes therein recorded, a process which caused some of them to acquire a somewhat heightened colour. In all essentials he is trustworthy, though his self-confidence may have led him in the end to assert as an established fact that which at the time he only believed to be true. His suspicious nature, moreover, may possibly have led him to suspect plots for his assassination, from which he says on several occasions that he only escaped by a miracle, when really none existed; though I myself do not believe that he did really overrate the dangers of the perilous situations in which he was so often placed.

In short Bruce, like Mungo Park, was a man to be respected as well as admired, and one of whom Scotland may well be proud. Bruce, moreover, needs none of our pity: for he had an intensely interesting and, on the whole, happy life, dying suddenly at home surrounded with every comfort when in the prime of life at sixty-four years of age; whereas Mungo Park, after the death of all or nearly all his companions, was drowned or killed at the age of thirty-four in the heart of Africa.

Time only permits me to briefly mention one other explorer to-night, and that mainly with the view of illustrating the need for further research in geographical biography. The name of Sir Alexander Mackenzie should undoubtedly be given a prominent place in the roll of honour of those who have helped to open out the great Canadian Dominion to civilisation; yet, as a fact, though laudable efforts have recently been made to make his deeds more widely known, few of us know anything at all about him. Mr. Burpee in his interesting book, *The Search for the Western Sea*, tells us that Mackenzie was born at Stornoway in 1763, whilst, according to the *Dictionary of National Biography*, that event took place at Inverness in 1755, a discrepancy which indicates how little his personality had been studied until recently, a neglect which is both a cause and an effect of our indifference as to his fame. When Mackenzie went to Canada as a poor lad in order to enter the fur trade, the Great Slave Lake was the furthest point in a north-westerly direction which had been visited by Europeans. After a very rough apprenticeship both in business and in travel, he set out on his remarkable explorations, in the first of which he discovered the Mackenzie River and traced its course for nearly 1500 miles to the Arctic Ocean, whilst, in his second great journey, he crossed over the Rocky Mountains from the Peace River, and was the first European to reach the Pacific Ocean by an overland journey in Northern America. And who was the man who did these great deeds? Must we be satisfied with his name only? Unquestionably he had that determination combined with great personal courage and great restlessness, which is ever a characteristic of great explorers. Some traits in his character may, moreover, be discerned by reading between the lines of his brief narratives, traits which indicate a far greater resemblance to Mungo Park than to Bruce. For example, when on his first journey he at last reached a tidal fiord on the Arctic Ocean, there is no display of emotion, no blowing of trumpets. Indeed we get the impression—probably an erroneous one—that he was unaware of the importance of his own performance. We may surmise also that there was a corresponding absence of all boastfulness on his part in the verbal accounts he gave of his journeys from the fact that they fell very flat at first. Indeed, soon after his return, he spoke of the river so rightly named after him as the "River Disappointment"—a river which he traced with "inexpressible toil" from its source to the Arctic seas, almost the whole way through inhospitable and previously unvisited lands. We know in fact what Mackenzie actually did in conjunction with his courageous French-Canadian voyageurs. We know also that when writing in 1801 he showed clearly that he saw the immense importance of transcontinental communication

in Canada, and that he did not hesitate to declare "that very great and essential advantages" might be derived by extending British trade from one sea to the other. And we may surmise that, if there had been more Alexander Mackenzies in the world, the marvellous development we have seen in the North-West would have come far sooner than it did. But of the man himself we know but little. In short, Scotland should not be satisfied until further efforts have been made to restore the picture of this striking personality; for Scotland possesses a valuable asset in the proof he gave of what can be done by a Scotsman in the way of overcoming difficulty and danger by sheer determination, and of this asset the greatest possible use should be made, especially as a stirring example to the young.

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## PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a Meeting of Council held on the 15th of February the undermentioned ladies and gentlemen were elected members of the Society:—

Miss Margaret Brown.
Miss Marion G. Brown.
Miss M. B. Ogilvie.
Miss Dollie Aitken.
Miss M. A. Hannan Watson.
Sydney Charles Berry, Esq.
Francis Walker Moir, Esq., M.B., C.M.
Rev. John M. Sloan.
Thomas Todrick, Esq., W.S.
Rev. Thomas Henry Walker.
Gilbert Innes, Esq.
Henry Wm. Christie, Esq.
James M. Wordie, Esq., B.Sc.
William Primrose Wilson, Esq.
Alex. Bremner, Esq., M.A., B.Sc., F.E.I.S.
Rutherford Fortune, Esq., S.S.C.
W. J. Anderson, Esq., C.A.
Chas. M. Ewing, Esq., M.A.
Sheikh Mohammed Hussan.
James Hutcheon, Esq., M.A.

The following were elected Teacher Associate Members:—

Miss Jane Low.
Miss Catherine R. Inverarity.
Miss Margaret B. Garvie.
Miss Minnie Tait.
Miss Marjory H. Ramage.
Mrs. Alice Thistle Bottomley.
William Calvert, Esq.
Donald Doull, Esq., M.A., A.R.C.Sc.

The Secretary read an extract from a circular recently issued by the Scotch Education Department, the practical effect of which, he was assured by teachers, would be prejudicial to the teaching of geography in secondary and higher grade schools, and asked leave to call a meeting of teachers to be held on Saturday morning, March 2nd, in the Council Room of the Society, at 11 o'clock, to consider this circular, and to draw up resolutions to be sent to the Education Department. Leave was granted, and the Secretary was asked to suggest to the meeting that the resolutions passed should be reported to the Council of this Society in order that they might, if they saw fit, give their support to them.

The Secretary stated that an intimation had been received of the death of M. Arthur de Claparède (cf. p. 90) from the Secretary of the

Geographical Society of Geneva, and was instructed to write a letter of condolence in which he should take occasion to express the recollection in the minds of the members of this Society who were present at the Ninth International Geographical Congress at Geneva in 1908, of the kindness and courtesy then shown to them by M. de Claparède, who presided over that congress.

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## GEOGRAPHICAL NOTES.

### Europe.

**Development of Servia.**—M. Gaston Gravier contributes to the *Annales de Géographie* an interesting article on this subject. The country has been undergoing remarkable development since the change of dynasty and recent improvements in the political situation. The latter was a serious check to progress some time ago, for on account of its uncertainty capital was excessively difficult to obtain, and what the country specially wants is improved means of transport, notably railways. The country is primarily agricultural, and while it produces chiefly wheat and maize, it owes to its relative humidity a great development alike of orchards and pasture. The chief fruit-tree is the plum, the product being largely dried for export; the pasture is of great importance because it makes Servia the only one of the Balkan States with a large pastoral industry. Commerce takes place chiefly in a north and south direction, the agricultural products going to the industrial countries to the north, the cattle, horses, sheep, and goats to the countries round the Mediterranean. Industry is beginning to develop, but as yet only on a small scale.

### Africa.

**Tropical Diseases in West Africa.**—The enormous amount of work to be done in combating tropical diseases in our West African dependencies is shown by two reports on entomological research in British West Africa which have recently appeared. These reports are by Dr. J. J. Simpson, who is working under the Entomological Research Committee for Tropical Africa (*Bulletin of Entomological Research*, vol. ii.), and the first deals with the Gambia, and the second with Northern Nigeria. Dr. Simpson returned to West Africa last month to continue his investigations in Sierra Leone and the Gold Coast. The reports deal fully with the distribution, habits, and haunts of those insects concerned with the transmission of malaria, yellow fever, sleeping sickness, and animal trypanosomiasis, and conclude with various recommendations for the extermination of these pests and the betterment of the health of the dependencies. The Gambia report deals with the whole of the dependency to MacCarthy's Island, 14° 45′ W.; the Northern Nigeria

report deals mainly with the Niger basin. Prior to the formation of the Entomological Research Committee and the despatch of Dr. Simpson little work had been done on these lines. It is only by systematic surveys of the infected districts and a careful study of the life-histories of the insects and other arthropods concerned that there is much hope of formulating definite schemes for the abatement of the diseases in question.

In vol. xx. p. 107 we reviewed here Mr. Austen's *Monograph of the Tsetse flies*, and indicated the great importance of this insect in connection with the opening up of the continent of Africa. Mr. Austen's work has been out of print for some time, and further, since its publication eight years ago, a great deal of additional research has been carried on upon the subject. The British Museum authorities have therefore published what is practically a new book, entitled *A Handbook of the Tsetse-flies*, also by Mr. E. A. Austen, which summarises the main points in regard to these pernicious insects, and is intended to be used especially by those engaged in combating fly-borne disease in Africa.

It is not necessary to add much to our previous note upon the subject, but it is of interest to point out that recently isolated cases of sleeping sickness have been discovered in the Nyasaland Protectorate and in North-Eastern Rhodesia, in regions where the fly called *Glossina palpalis*, hitherto believed to be the only carrier of the disease, is absent. Here other species of the same genus of flies are believed to transmit the disease, a discovery which adds a new and painful interest to the study of the tsetses, as showing that the absence from a particular locality of *Glossina palpalis* does not, as was believed, give immunity from sleeping sickness.

## General.

**Association of American Geographers.**—Prof. A. P. Brigham informs us that the Eighth Annual Meeting of this Association was held in Washington, December 28-30, 1911, the sessions being held in the Hubbard Memorial Hall. The President, Professor Ralph S. Tarr, of Cornell University, presided, and gave the president's address. His subject was "The Glaciers and Glaciation of Alaska." Professor Martin read a memorial of Professor Christopher Webber Hall, who died on May 10, 1911. In addition to these addresses, thirty-six papers were read by members and by several others on invitation. Papers on subjects in Meteorology were more numerous than at any previous meeting of the Association. On one evening the Association met with the Geological Society of America to hear the address of its president, Professor W. M. Davis, upon the subject "The Relations of Geology and Geography."

The first volume of the *Annals* of the Association is now in press, and will appear shortly under the editorship of Professor B. E. Dodge. Announcement was made of the election of the following officers for

the year 1912: President, Rollin D. Salisbury; First Vice-President, Marius R. Campbell; Second Vice-President, Isaiah Bowman; Secretary, Albert Perry Brigham; Treasurer, Nevin M. Fenneman; Councillor for three years, Lawrence Martin. The next annual meeting will be held in New Haven.

## Commercial Geography.

**Norwegian Industries.**—A very instructive article on this subject appears in a recent issue of the *Popular Science Monthly*, which gives an interesting account of the changes which are being produced in the country by the increasing development of electrical industries. A full account is given of the manufacture of calcium cynamide at Odda, on the Hardanger-fiord. Here calcium carbide is first produced by reducing limestone with coke in an electric furnace, and the carbide is then converted into cynamide by heating in an atmosphere of pure nitrogen. The method of obtaining the latter gas is exceedingly interesting. Atmospheric air is dried and deprived of all carbonic acid, and is then liquified, the difference in the boiling points of liquid oxygen and liquid nitrogen being used to separate the two gases, much as in the case of a mixture of water and alchohol. Almost pure nitrogen is thus obtained, and the calcium carbide is powdered and exposed to the action of the gas, heat being applied to start the process. As yet no use has been made of the nearly pure oxygen which is left, though this ought to have a high commercial value. The cynamide when treated with water yields pure ammonia which is converted into the sulphate by sulphuric acid, and sold as an artificial manure. The power is obtained from streams, some four miles from the plant. At present the fall is sufficient to produce 22,000 horse-power, but it is said that by raising the level of the supply 125,000 horse-power can be obtained. The great geographical importance of the industry depends upon the fact that the market for the product is almost unlimited, and as the necessary conditions for the starting of the industry are only water-power, and a supply of limestone—both widely spread in Norway, the possibilities of future development are very great.

Another recent development is the manufacture of artificial saltpetre. This is done by producing nitric and nitrous acids by passing powerful electric currents through atmospheric air, then leading the resultant gases through water and neutralising with limestone. The product can compete with Chili saltpetre even on the Pacific coast. By a somewhat similar process ammonium nitrate, used in the manufacture of explosives, can be produced.

No less than twelve electrical industries of various kinds have been already started in Norway, and several others are ready to begin work. If sufficient labour can be obtained in this somewhat scantily populated country, there seems little doubt that those new industries will modify the conditions of life enormously.

## EDUCATIONAL.

Journal of Cartography and School-Geography.—There has been recently added to our list of exchanges a new journal entitled *Kartographische und Schulgeographische Zeitschrift*, published in Vienna in ten parts per annum. The object of the journal is to promote the teaching of geography in general in schools, but especially to urge the need for adequate instruction in map-reading and the use of maps, and to further the publication of suitable aids to this end. Thus in the first issue we have an article by Dr. Anton Becker on *Kartenkunde* in which the author emphasises again the folly of allowing elementary students to obtain their ideas of maps from the highly generalised and abstract maps of the school atlas, instead of from a large-scale map of a familiar region. Curiously enough he recommends that first studies in maps should if possible be begun with a map representing a nearly plane surface. He recommends that such a surface should be studied in maps of successively diminishing scale, to show how detail after detail vanishes. In another article, which is illustrated by a coloured map, the relation of bird's-eye views to maps is discussed, and it is shown that a carefully selected picture is of great help in the interpretation of a map. Several other articles together with notes are included in the issue sent to us, and indicate that the journal should be valuable to those teachers who read German.

Practical Exercises in Map-drawing.—Mr. D. W. Johnson, whose views on the best methods of teaching map-drawing in schools we discussed in vol. xxvi. p. 552, has sent us a little pamphlet with the above title, accompanied by a packet of blank map projections and outline maps. The blank projections include such familiar ones as the Globular, Orthographic, Conical and Mercator's, and are intended to be used by scholars for map-drawing, either from memory or by copying, with the double object of familiarising them with the outlines of the continents, and with the characters of the common projections. The text describes a series of exercises to be performed with the blank projections, concluding with an excellent account of the commoner forms, which is to be illustrated by maps drawn by the scholars on these projections, the same region being mapped in each case. The exercises seem interesting and well graduated, and Mr. Johnson has certainly obtained excellent results from their use, so that teachers may be glad to have them brought to their notice. We may perhaps recall here that the essence of his memory method is that the scholars should be instructed to learn a certain number of latitudes and longitudes of outstanding places on each continent or country to be drawn, and that they should first insert these on the blank projection, and then fill in the remainder of the map. The places selected should be those occupying a prominent position on the coastline, such as headlands, capes, peninsulas, and so on. If these are fixed it is comparatively easy even for young children to draw very accurate maps.

# NEW BOOKS.

## EUROPE.

*Undiscovered Russia.* By Stephen Graham. With 26 Illustrations and 3 Maps. London: John Lane, 1911. *Price* 12*s.* 6*d. net.*

The title of Mr. Graham's book is not to be taken in its most literal sense, for much of the country traversed by him, from the Caucasus to Archangel, is familiar to those West Europeans who know Russia. His discovery is of the inner life of the people, which his knowledge of Russian and his method of travel, on foot, enabled him to realise and to describe with an intimacy impossible to travellers in sledge or droshki. Mr. Graham's literary style has moreover a special charm, reminiscent of R. L. Stevenson in his *Travels with a Donkey in the Cevennes.* Nor is it only in his descriptions of peasant life that he discovers Russia to the untravelled Western. The strong religious feeling of the people is manifested in every chapter. The author's talks with the exiled revolutionaries in the North are particularly illuminating, for he associated with these interesting people in the most friendly way, and learned something of their ideas of political and social matters. Ethnologists, however, will be disappointed with the scanty and inadequate references to "the Ziriani, the Samoyedes, and other aborigines." The disreputable ways of the former are described at pages 136-140, but of their physical appearance the author gives us no hint, merely stating that he "stared across at the strange party of savages sitting on the sand." A few pages later, it is true, he tells us that "they were in red and black chequered flannelette shirts, broad belts, baggy cotton trousers and jack boots," but this scarcely differentiates them from ordinary moujiks. Apart from such objections, *Undiscovered Russia* is a book which reveals to us, in the most graphic manner, the actual world in which the Russian peasant lives; and the interest of its pages is certainly not lessened by the frequent manifestation of the author's personality.

*The Wonderful Weald.* By Arthur Beckett. London: Mills and Boon, Limited. *Price* 10*s.* 6*d. net.*

This is a delightful book for a lazy day. The writer starts off on a stroll over the Wonderful Weald of Sussex with Aminta in pursuit of the crock of gold, which, as we all know, is to be found where the rainbow touches the earth. On this flimsy and playful idea he has compiled wealth of graceful amusement and solid entertainment for all sorts of readers. He relates with much literary charm and easy grace several of the exciting and adventurous incidents recorded in history of a number of well-known places in Sussex, and he is equally skilful and attractive in the wide realm of romance, historical, ecclesiastical, legendary, and fanciful. Then there are heaps of good amusing local stories, some of them none the worse for being chestnuts, some excellent samples of folklore, and a number of more or less passable pieces of poetry. Tales of the days of the smugglers and gypsies contribute to the variety of the reading, and we have amusing descriptions of local customs, dances, Christmas plays, and the like. In one of the journeys in pursuit of the crock a stranger says to the writer, "May I ask why you take this journey?" to which he replies, "Because we seek the romantic and picturesque; in addition, we go in search of truth." The reader who accompanies the party in their quest will find plenty romance and picturesqueness, and reading between the lines he will find not a little truth as well as pleasant entertainment. Several of the colour illustrations are very good.

*The River Findhorn.* By GEORGE BAIN. Nairn: Published at the "Nairnshire Telegraph" Office, 1911.

This handsome and well-illustrated book will be much appreciated by a great variety of readers. The author has brought to his task great local knowledge and experience and a vast amount of information, historical, legendary and scientific, of which he has made most judicious use. To this we have to add, that he has a keen and appreciative eye for the beautiful scenery of this romantic region which he describes, and any one who visits the valley of the Findhorn could desire no better qualified cicerone. With patient and erudite industry he has taken toll of ancient documents, ecclesiastical and secular, with which to illustrate and enliven the story of the great Highland clans, whose descendants, the Mackintoshes, Murrays, Macphersons, Grants and others still dwell on both sides of the river, and he has skilfully compiled much material for the delectation of the artist and sportsman. From time to time he depicts with vivid and graphic touch the manners and ways of life of bygone centuries, and the reader lays down with regret a book in which the interest never flags.

*Nooks and Corners of Cornwall.* By C. A. DAWSON SCOTT. London: Eveleigh Nash, 1911. *Price 2s. 6d. net.*

The plan of this book is to follow the coast from the northern point of Cornwall, near Bude, to Land's End, along the south coast to the mouth of the Tamar, and then deal with the inland regions. The information is given conveniently under brief headings, and will be of great interest to the tourist. But even to one who has no immediate intention of visiting the county the little book is well worth attention. The romance of Cornwall, its history, its poetry, its personalities as given here make delightful and instructive reading, and are not the result of an *ad hoc* study. One may notice that the author is not inclined to support the local claim upon Arthurian legends. A map and a full index are usefully included.

*Letters from Norway.* By Sir WALTER F. MIÉVILLE. London: Simpkin, Marshall and Co., 1911. *Price 2s. 6d. net.*

This little book is said to consist of a series of letters written by the author during a cruise to Norway to his wife, whose portrait forms the frontispiece of the volume. It opens with some verses by the author, and concludes with a verbatim report of the speech made by him at the last dinner on board the ship; "laughter" and "cheers" being duly inserted at suitable intervals in the course of this speech. In between, interspersed with funny stories and verses, will be found some account of the country of Norway.

*Cambridge County Geographies. The Isle of Man.* By the Rev. JOHN QUINE, M.A. *Monmouthshire.* By HERBERT A. EVANS, M.A. *East London.* By G. F. BOSWORTH, F.R.G.S. Cambridge: At the University Press, 1911. *Price 1s. 6d. each.*

This useful series is progressing fast, nearly thirty English volumes and several Scottish ones having already appeared. Of the three volumes named above perhaps the most generally interesting is *East London*, which includes a valuable discussion of the causes which determined the choice of the site of the city of London. The *Monmouth* volume is also interesting in that it treats of a frontier zone where two civilisations meet; especially noteworthy is the discussion of the contrast between Welsh and Teutonic methods of agriculture and their effects upon the distribution of the population.

## ASIA.

*The Emir of Bokhara and his Country.* By Professor O. Olufsen, Secretary to the Royal Danish Geographical Society. London: William Heinemann, 1911. *Price* 21*s. net.*

This substantial volume is a somewhat belated result of the Danish Pamir Expeditions in 1896-7 and 1898-9 from the pen of Lieutenant Olufsen, commander of these expeditions, now a professor in Copenhagen. So far as Bokhara is concerned, the delay of a dozen years or so is of no importance, for Bokhara is one of a few countries in Asia which have not been much affected by the historical events of the last thousand years, and with few exceptions the habits, customs, laws, religion, etc., of the population have not changed for centuries. The basal reason for this is that the religion of Islam has been paramount since the eighth century; the Russian conquerors have hardly interfered with it, and the inevitable result is that social and economic progress has been slow in the extreme. Bokhara itself is now a semi-independent state under the protection of Russia. The Emir is not allowed to live in his own capital, and has to obey any orders conveyed to him from St. Petersburg. But interference has been judiciously confined to the abolition of certain barbarous customs such as slavery, inhuman forms of torture and punishment and the like; of course Russia regulates the whole of the Emir's relations with his neighbours.

A careful perusal of Prof. Olufsen's work prevents us from recommending Bokhara as a pleasant place to visit. In the first place, even if the traveller moves about it under the aegis of the Russian government or the Emir, he runs considerable personal risk even of his life, and wherever he goes he may be hailed generally as "Dog!" or "Infidel!" and he runs a good chance of getting into serious trouble by unwittingly exciting the anger, rousing the jealousy, or insulting the religious susceptibilities of some of the inhabitants. Even the climate for some ten months in the year is more or less intolerable to Europeans. "The typical climatic features in all regions are the early spring (April and May) with its smiling fertility, the rainless hot summer with a bright sun and a cloudless sky where everything is dried up when not watered artificially, and where all that is green in the irrigated oases is covered by a layer of yellowish grey loose dust, and the calm nights with their sparkling stars and a brilliant milky way which not even the moonlight is able to outshine. An excessive drought in summer-time sucks out every bit of moisture from clothes, woodwork, and other things, so that, for instance, woodwork is simply eaten up by sun and drought, and brightly polished cutlery never becomes rusty in summer. Add to this the abrupt change in temperature from day to night, and especially a sudden violent change in the temperature of the mountain valleys when the sun suddenly disappears behind the mountain crests. Strong extremes of summer and winter are prevalent. As suffocating as may be the summer heat, as villainously cold is it in winter." With the hot weather come plagues of insects, cockroaches, mole-crickets, scorpions, tarantules, and above all mosquitoes, and occasionally black hornets which always attack the eyes of man or beast. In Bokhara the devastation, which in India is caused by locusts, is caused by grasshoppers. "In swarms standing out like large black clouds they traverse in the month of May steppes and oases, settling in the green grass or in the cornfields, eating up everything down to the roots. The reddish brown insects, not yet full grown, cover the ground so densely that nothing but grasshoppers is seen within many miles. They sit so close on the tents of the Kirghiz, on houses, carriages, stations, etc., that each spot is

hidden by them. The rails are strewn with them, and the wheels of the engine whirl round in the greasy mass of crushed animals while the train does not make any progress. The passengers get down, and by means of rice-brooms, tamarisk-branches and suchlike sweep the animals off the rails and then strew sand on the latter in order to set the train agoing again. Later in the year the full-grown individuals with their large wings are often seen glittering in the sun in large swarms. In the steppes the Kirghiz set fire to the rich growth of grass round the swarm of grasshoppers, and in the oases ditches with fires are dug all round them, and they are burned alive in the irrigation canals. This plague does not fortunately occur every year." In autumn, in the low grounds, malarial fever is very prevalent. "Winter is a dreary season for the people in Bokhara. Even the rich feel chilly in their badly heated houses and in the open air in spite of their thick fur-cloaks. The mountain valleys and their towns are cut off from one another, a heavy, dark icy air lies over the level country, the poor and the cattle often die for want of food and from cold; for the Orientals do not collect provisions for themselves and their cattle. The caravan travels are suspended, the traffic with gemas on the Amu has ceased, and the bazars are dreary and cold. All life seems to have become extinct, until the spring sun again reanimates the realm of the Emir." The Russians have constructed a line of railway from Chargui to Samarcand, *viâ* the capital and Kerminah, but with this exception commerce and the traveller in Bokhara are dependent on "the old caravan roads through deserts, steppes, oases, and mountains, and the old-fashioned way of transporting goods which was in use at the times of Timur, Jenghis Khan and Alexander the Great."

But if any adventurous reader, undeterred by such considerations, cares to travel in Bokhara, he could not have a better guide than Prof. Olufsen. He has devoted unwearied industry to collecting, marshalling, and setting forth a vast amount of facts, and his book is most valuable as the work at first hand of an expert eye-witness, of exemplary patience and perseverance, with exceptional opportunities for seeing and investigating everything in the country, of which he took full advantage. The book is abundantly illustrated with good photographs, and there is an excellent map; but the Professor has severely refrained from enlivening his learned and detailed descriptions by many anecdotes or straining after eloquence or attractions of style. His work, on the whole, is dry reading, but has abundant merit as an instructive and valuable compendium of facts, scientific, social and economic.

*Arabic Self-Taught (Syrian). With English Phonetic Pronunciation.* By A. Hassam. Enlarged and Revised by the Rev. N. Odeh. Fourth Edition. Marlborough's Self-Taught Series. London: G. Marlborough and Co., 1911. *Price* 2*s.* 6*d.*

This new edition has been re-written and much new matter added, so that it practically constitutes a new work. It should prove most useful to any traveller in Syria who wishes to acquire some knowledge of the language of the country in which he is journeying.

*The Land of Uz.* By Abdullah Mansûr (G. Wyman Bury). London: Macmillan and Co., Limited, 1911. *Price* 8*s.* 6*d. net.*

This is a pleasantly written and well illustrated book, in which the author describes to us a country of which very little is generally known, viz., the region of Arabia to the north-west of Aden, which in the maps is called the Hadramant. The author is an officer attached to the staff of the Political Resident at Aden.

He was engaged for some twelve years in a great variety of work, such as surveying and conducting the intricate and delicate negotiations which continually arise in a semi-civilised region peopled by turbulent, fanatical, and unscrupulous tribes. In this book he records his observations and impressions of the country and the inhabitants, first of the tracts under the British Protectorate, and afterwards of outlying tracts, which, until he entered them, had not been visited by Europeans. For the dangerous task of visiting these tracts he had to adopt the disguise of a down-country Arab chief. At one place in his book he deprecates on the part of his readers the impression that "the average desert-dweller in these parts is quarrelsome and addicted to indiscriminate bickering," and he adds that "for one confirmed raider there are twenty quiet respectable tribesmen who only participate in big official raids on very special occasions." But certainly the average reader would come to a different conclusion from a perusal of this book, in which undoubtedly the most stirring pages are those in which the author describes with picturesque vividness and much literary skill the exciting adventures and dangers of the journeys in which either he was raided or in which he was sent on a punitive expedition against offending tribesmen. Night and day they had to maintain the strictest watch, as they marched through tracts where, apparently, to be seen in the company of a member of another tribe, or to be coming from the direction of their lands, or even to be a stranger, was a sufficient cause for being "sniped" or attacked. Not less interesting to many will be the amusing and instructive recitals of conversations and interviews with all ranks of the inhabitants from sultans to camelmen, in which the author shows a profound knowledge of character and the working of the Mahommedan mind, and the tact and finesse which are essential to success in the diplomatic service. Abdullah Mansûr is blessed with a happy sense of humour, which must have stood him in good stead in many a tight place, and at the same time he shows what always profoundly impresses the Oriental, imperturbable coolness in danger, fertility of resource, prompt decision and immediate action. He has exceptional qualifications, essential for success in an explorer in the unknown deserts of Arabia, in physical strength, a thorough mastery of the language and peculiar methods of thought of the inhabitants, and conciliatory manners and tact based on a comprehensive acquaintance with the customs, prejudices and superstitions of the people, which have evoked in him a sincere sympathy, and even admiration for them. More than once he hints at his desire to explore the Great Red Desert of Southern Arabia, and we cordially agree with General Maitland, the ex-Political Resident at Aden, when he says that there is no one better qualified than Abdullah Mansûr for such a work. As it is, this book is undoubtedly a valuable addition to our knowledge of a little known region, and as such will be welcomed by students of geography and ethnography. We have already alluded to the many illustrations, and we have to add that there is also an excellent map.

## AFRICA.

*Man and Beast in Eastern Ethiopia. From Observations made in British East Africa, Uganda, and the Sudan.* By J. Bland-Sutton, F.R.C.S.Eng. With 204 Engravings on Wood. London: Macmillan and Co., 1911. *Price* 12*s. net.*

This book, as the title indicates, has a somewhat wide scope, for it includes not only animals but man, both subjects being very fully treated. Mr. Bland-Sutton first gives a general account of the country, then a minute description of the various tribes with their manners and customs. Frequent references are made to

other writers, but it is obvious that the author has done much original investigation. Chapters are devoted to representative animals, and while the method is strictly scientific and there is no straining after effect, dullness and dry-as-dustness are entirely absent. We note one small point. On page 71 the author says, "in the verandah there was a pretty serval cat chained up by the collar like a dog, quite tame, eager and willing to receive caresses." On page 175 the serval cat is said to be "a pretty but untamable animal." The essays on the Rift Valley are of particular interest and value, and we consider that Mr. Bland-Sutton's work will remain a standard for the natural history and ethnology of Ethiopia. Messrs. Macmillan and Company have, as always, done their part well, and the excellent wood-engravings are quite refreshing to an eye surfeited by a long course of soulless photographs.

*The Guide to South and East Africa, for the use of Tourists, Sportsmen, Invalids and Settlers.* Edited annually by A. Samler Brown and G. Gordon Brown, 1911-12 Edition. London: Sampson, Low, Marston and Co. *Price* 2*s.* 6*d.*

This very cheap and useful guide shows the usual features, no notable changes having been made since the last issue. Its value is already well known to all those who have occasion to visit South Africa in any capacity.

## AMERICA.

*Mexico: A General Sketch.* Compiled by the Pan-American Union. Washington, D.C., 1911.

This handbook has been compiled to meet the growing demand, particularly in the western commercial world, for reliable information about Mexico, and is likely to prove of great use to those who wish without much trouble to gain a general acquaintance with the past history, present conditions, and future prospects of that large part of the American Continent. The area of Mexico is stated to be 765,537 square miles, but mention is made of the territory once Mexican, but now belonging to the United States, which is no less than 930,590 square miles in extent. More than half of the old Spanish territory has passed since 1847 from the weaker to the stronger republic, and who can say what may happen to the remainder during the half-century that is to come? A country with many antiquities to make it interesting, as well as possibilities of much development, both agricultural and mineral, a temperate climate over large tracts where white men can live in health and comfort, and a comparatively small population, is indeed an interesting subject to contemplate from the other side of the border. Such a land deserves and needs a good government, but until the reign of General Porfirio Diaz began about thirty years ago this was unknown, and it is only recently that the country has begun to awaken to the benefits of a peaceful and orderly administration. Now that President Diaz, the maker of modern Mexico, has been dismissed without thanks, and revolution has placed another president at the head of affairs, it will be interesting to wait and see if the country will continue to prosper and evolve good government without resorting to the cruelty and bloodshed that, no doubt, stained many pages of the late "benevolent" autocrat's history.

The area of Mexico is equal to that of Spain, France, Germany, Italy, Switzerland, Holland and Belgium put together, but the whole population of this vast territory, according to the census of 1910, is not more than 15.063,207, or something under 20 per square mile. About half the population can neither read

nor write, but education is rapidly diminishing the number of illiterates, most of whom belong to the aboriginal Indian tribes. There is room for more people, and while undesirable immigrants are not admitted, colonies of Frenchmen, Italians, Germans, Mormons and Boers have been permitted to settle in different parts of the country. Hospitality was offered to the Boers in 1903, and a settlement in the State of Chihuahua has shown, we are told, that they form the type of emigrant desired to fill up the waste-places in the republic. Among agricultural products reference is made to Mexican rubber derived from the native plant the *Castilloa elastica*, but it is admitted that no part of the republic can compete with the rubber-producing regions of Brazil, and a word or two of caution is addressed to would-be growers of this valuable product.

Many maps and excellent illustrations with diagrams and statistical tables give the reader who wants to gain the maximum of information with the minimum of trouble all that he can reasonably wish to know about the present state of the country, its trade, industries and government, and to all such readers this well-arranged compendium will prove a valuable book of reference.

*Report on the Dominion of Canada Government Expedition to the Arctic Islands and Hudson Strait on board the D.G.S.* 'Arctic.' By Captain J. E. Bernier, Officer in Charge and Fishery Officer. Ottawa: Government Printing Bureau, 1910.

It is curious and unfortunate that such publications of the Government Printing Bureau at Ottawa as we have seen, are composed of paper of very poor quality. We are not sufficiently expert to know if the paper is made from wood-pulp, but whatever the material, it forms a very bad medium for the reproduction of photographs. Some of the maps and charts enumerated in the list of illustrations are not included in the copy before us, and there is no map by means of which one might follow the general route of the *Arctic*. The main report is contributed by Captain Bernier, the chief of the expedition, and it gives an account of how he fulfilled the duty entrusted to him of formally annexing the huge archipelago to the north of Canada. Supplementary reports are appended by several of the assistant officers, giving information as to the meteorology, geology, botany, biology, and tides of the regions visited. The most interesting portions are those which describe visits to the Bay of Mercy, where no traces were found of M'Lure's ship, the *Investigator*, and to cairns built by the many searchers after Franklin. Copies, in some cases in facsimile, are given of documents left by Kellet, M'Clintock, and others. The geologist of the expedition made a careful investigation of the areas where coal was reported by previous explorers, and while a considerable quantity of loose coal was picked up, no seams of importance were actually located.

The whole volume consists of 529 pages, and is written throughout in the conscientious but dry style which seems inseparable from most official reports. Some of the entries in the Index make one wonder upon what principle, if any, the compiler worked.

## GENERAL.

*My Climbing Adventures in Four Continents.* By Samuel Turner, F.R.G.S., Author of *Siberia: A Record of Travel, Climbing, and Explorations.* With 74 Illustrations. London: T. Fisher Unwin, 1911. *Price* 12*s.* 6*d. net.*

For a man with no pretensions to scientific training Mr. Turner has accomplished some good work, and we welcome this chatty account of his exploits. He has accomplished some wonderful feats of endurance, such as the traverse of Mount

Cook, and the late winter journey to the Altai Mountains. Mr. Turner may be pardoned for his tendency to vain-gloriousness—which, like his capacity for endurance, may be set down to the fact that he is a teetotaller and a non-smoker, and is a rather engaging peccadillo if not carried too far—but he should avoid meddling with science. For instance, he says of the Altai: "Most of these mountains appear to have been split in half quite recently by some powerful upheaval of the earth. One proof of this was the extreme softness of the rock which had tumbled from the peaks and had sharp edges which did not show the slightest wear by ordinary denudation. Some of these rocks were so soft that I could break them by letting them fall three feet." There is something baffling about these statements, and they do not really form a sequence. Regarding Mr. Turner as a climber we have only to say that theoretically he should have been killed long ago. There is scarcely a canon of mountaineering which he has not broken, and while courage is always admirable, foolhardiness is not. The illustrations are very fine, and the book is excellently got up. A map, even a rough sketch, of the approaches to the Altai would have been of some assistance to the reader.

*The Wanderings of Peoples.* By A. C. Haddon, Sc.D., F.R.S. Cambridge: University Press, 1911. *Price* 1s. *net.*

In this excellent little manual Dr. Haddon, the Cambridge University Reader in Ethnology, has condensed into the small compass of about 100 pages a vast amount of information regarding the migrations of human races all over the two hemispheres. It is a huge subject on which many volumes have been and will be written, for the matter is one of perennial interest, and fresh materials for its elucidation are being discovered, and often literally unearthed, from day to day. In the meantime, Dr. Haddon has compiled, with much patience and skill, a bare statement of what is already known about it, and has indicated to his readers in the bibliography appended to each chapter where they will be able to verify his conclusions and extend their studies. In a brief but learned introduction he indicates the main causes which lead to migrations and control or modify their course, and the evidence, historical, ethnographical, geographical, philological, etc., which the student of migrations must examine and test, ere he form his conclusions. One sentence from the preface is well worth quoting: "The study of human migrations emphasises the fact that ethnology and history can be satisfactorily elucidated only from the geographical standpoint." The patience and skill with which the subject has been treated, combined with its intrinsic interest, should secure for this manual a wide circle of readers.

*Under Western Skies.* By Francis Sinclair. London: Sampson Low, Marston, and Co., Ltd., 1911. *Price* 6s.

The scene of the first of these four sketches is laid in Australia, and a very lurid description is given of the effects of the great drought which prevailed a few years ago, and of the transformation effected by the putting down of artesian wells. The other three sketches refer to other parts of the world.

*Weather Science: An Elementary Introduction to Meteorology.* By F. W. Henkel, B.A., Fellow of the Royal Astronomical Society, etc., etc. London and Leipsic: T. Fisher Unwin, 1911. *Price* 6s. *net.*

The only excuses for a new text-book on any subject are that it brings in new matter, sums up the old better than has been done before, or is cheaper than previous works. Mr. Henkel's book does not fulfil any of those conditions. There is only a passing notice of what has been accomplished by the use of kites,

and no reference whatever to *ballons sonde*. One observes also a considerable amount of irritating and unnecessary repetition, and an inexactness in the use of figures, which should not occur too often in a text-book. For example, on p. 149 it is stated that "in about fifty years' time *true* and *magnetic* north will coincide"; on p. 221 we find that they will coincide "in about sixty-five years' time." On p. 282 the atmospheric tide due to the influence of the moon is said to be represented in the barometric pressure by a few hundredths of an inch; this becomes a few thousands of an inch on p. 289. The isotherm of 50° F. crosses the centre of Ireland in latitude 55° on p. 297, and returns to it in latitude 53° on p. 298. The mean annual range of temperature at Verkhoyansk is given as 100° at the middle of p. 299, and as 120° at the bottom of the same page. The "record" low temperature at Verkhoyansk is −80° on p. 299, and −81° on p. 302. We are under the impression that −93° F. have been recorded at that place. There is a peculiarly vicious split infinitive—"to alone give"—on p. 289, but we suppose it is hopeless to insist upon purity in that respect nowadays. The Ben Nevis Observatory is dismissed in one sentence, and it is even ignored in the index. The sentence is worth giving—"For some years a meteorological observatory was maintained on Ben Nevis, in Scotland, the highest of the British mountains; supported by a grant from the government and the Royal Meteorological Society, but it has been since abandoned." In the first place no grant has ever been given by government; secondly, the grant by the Royal Meteorological Society was only £100 per annum; thirdly, the Ben Nevis Observatory was originated, and, but for the above grant, entirely supported by the Scottish Meteorological Society by means of a special fund contributed to by donors of large and small sums from all over Scotland. By the way, the Scottish Meteorological Society is not once mentioned in a book which professes to give a general account of the science! If it had done nothing else but establish stations in Iceland by which was proved the existence of a permanent cyclonic area near that island, it would have been worthy of at least a passing reference in less pretentious works than that of Mr. Henkel.

*Specimens of Bushman Folklore.* Collected by the late W. H. J. Bleek, Ph.D., and L. C. Lloyd. London: George Allen and Co., Ltd., 1911. *Price* 21*s. net.*

In a much too brief introduction to this remarkable book Dr. Theal says of the race of Bushmen that "there is good reason to believe it once extended not only over Africa, but over a large part of Europe, over South-Eastern Asia—where many scientists maintain it is now represented by the Semang in the Malay Peninsula, the Andamanese, and some of the natives of the Philippine Islands—and possibly over a much greater portion of the world's surface, a race that had made little, if any, advance since the far-distant days when members of it shot their flint-headed arrows at reindeer in France, and carved the figures of mammoths and other now extinct animals on tusks of ivory in the same fair land. It was truly an ancient race, one of the most primitive that time had left on the face of the earth." But "there is no longer room on the globe for palæolithic man," and the fate of the Bushmen in Africa has been sad and hard. Pressed and harassed on every side by invaders by land and sea they have practically vanished, until "to-day there is not an acre of land in all South Africa left to the ancient race." It was left to a German savant, Dr. Bleek, who had already won his literary spurs by learned works on the Hottentot and Bantu languages, to rescue from oblivion the language and folklore of the Bushmen. The difficulties of the task would have

daunted any ordinary worker, for at the outset the only available materials for the work had to be laboriously extracted from two Bushmen convicts at Capetown. Dr. Bleek began the work in 1870, but unfortunately he died in 1875, after which the work was pluckily and effectively continued by his sister-in-law, Miss Lloyd, till 1887. Two formidable difficulties, viz. that of finding a publisher and ill-health, combined to delay the publication of the work till now. It is divided into two parts; the first contains a number of folklore stories, mythical, fabulous, and legendary, and the second contains similar stories of animals and accounts of Bushmen customs and superstitions. All these were more or less dictated and explained to Dr. Bleek and his sister-in-law by Bushmen whose confidence they had won over by kind treatment. A glance at Miss Lloyd's preface indicates some of the difficulties of the work. For example, it was necessary to invent and add a considerable number of signs to represent sounds unknown in any alphabet. Thus they had to represent five different clicks—the dental, the cerebral, the lateral, the palatal, and the labial; also two "croaking sounds," one strong and one gentle, in the throat, and so on. A glance at a page of any of the stories shows what a formidable task the printer has achieved. A perusal of the folklore indicates an exceedingly primitive plane of intelligence, which although somewhat out of the range of the geographer, is of the greatest interest to the archæologist and ethnographer, while the peculiarities and idiosyncrasies of the grammar must interest and possibly perplex the grammarian and philologist. Unquestionably Dr. Bleek and Miss Lloyd have compiled a most important work, and made a rich contribution to the treasury of philology and archæology, all the more valuable because they rescued from oblivion materials which in a very short time would have perished for ever.

*Influences of Geographic Environment: on the Basis of Ratzel's System of Anthropo-Geography.* By Ellen Churchill Semple, Author of *American History and its Geographic Conditions.* London: Constable and Company, Ltd. New York: Henry Holt and Company, 1911. *Price* 18*s. net.*

In the preface Miss Semple explains that her original intention was to translate into English Ratzel's great work, *Anthropo-Geographie.* Knowing that the work was "difficult reading even for Germans," and finding that for various reasons anything like a literal translation was impossible, and that some of Ratzel's conclusions were based upon insufficient data, she came to the decision to write what was practically a new work. The result is a volume of nearly 700 pages, giving a remarkably complete presentation of geography from the anthropological side. It is a satisfactory answer—if an answer were required by one of unbiassed mind—to the charge lately made that geography is not a science, but a hanger-on of other sciences, a picker-up of crumbs falling from their table, with a suspicion of larceny when unobserved. For under no other heading but that of Geography could this book be placed. The first chapter gives a general account of the operation of geographic factors in history. Here we must in some measure disagree with the author. The word "anthropo" is prefixed to the word geography on the title-page, but it is frequently absent throughout the book. Now in discussing the relation of geography to history it is of vital importance to know what the author means by geography. By using it alone in this connection she seems to claim that she has covered the whole field, in other words, that Anthropo-Geography is Geography. If that is so, she will find few to agree with her. Such an argument would lead the enemy to say that the title should not be Anthropo-Geography but Geographic Anthropology. It is true that History and Geography

are related, but the former is the handmaid, not the mistress. Geography deals with present conditions. To understand these fully, she must, when going back to the past, call in the aid of history as well as of other sciences, just as the botanist, for example, depends upon geology and meteorology. History, on the other hand, deals with the past, and all will admit that without a knowledge of geography and of historical geography, as it might be called, a complete understanding of the past is impossible.

Chapter ii. deals with the varying effects, direct and indirect, of environment on man, leading in the next chapter to the relationship of society and the state to the land. The comparative impermanence of political as contrasted with social geography is well brought out. The names of France and Spain are now but memories in the new world, but the peoples of French and Spanish descent remain. Here was an opportunity, which the author does not altogether seize, of emphasising the importance of physical geography. Environment in all its varied aspects is everything in the growth of mankind.

In Chapter iv. is discussed the geographical significance of movements of peoples. Here we should have preferred a reference to the elementary but necessary fact that the configuration of a region favours or retards or even prevents advance. The chapter on Geographical Location is in our opinion the best in the book, for the reason that it is purely geographical. It is in fact the real beginning of the book, and we have nothing but favourable criticism for the remainder. The classification of location into central, peripheral, scattered, and in a related series is excellent. Might we suggest the word "linked" for the fourth type? Though less important, the question of area is of great significance. The hot-house growth of island peoples is contrasted with the natural, slow, but steady progress of continental nations. Hence arises a discussion on boundaries, those which are favourable to expansion and those which forbid it. The most important boundary is the ocean, so coast peoples have before them what is at once a barrier and a threshold.

In the chapter on the Oceans the author points out the inadequate treatment they receive in most, if not all, text-books. This is really due to want of information, and Miss Semple would be the last to favour vague generalisations which are based on few data. We may look in the near future, especially in connection with commercial geography, for the utilisation of the valuable information about the oceans which recent expeditions have provided. A consideration of man's relation to the water naturally leads to the study of rivers. An ocean without navigable streams flowing into it is like an octopus without tentacles. Large rivers imply large areas of land, the continents. Then comes a contrast, continental with island peoples, taking the peninsulas as half-way ground. Returning to the Continents we are taken to plains, steppes, and deserts to investigate the influences on their peoples of these kinds of environments.

The next two chapters, on Mountain Barriers and their Passes, and Influences of a Mountain Environment, we place second only to that on Location. We should be very much surprised if we were told that Miss Semple had not visited the Alps, for in them there is evidence of "grip," definiteness, and clarity which can spring only from personal knowledge. The last chapter treats of Climate, and gives a summary of what had been previously said in different chapters. There is a suspicion that the author in her justifiable eagerness to emphasise the importance of other geographical factors has rather minimised that of climate.

In conclusion we should like to draw attention to the wealth of apt allusions, and the abundance of picturesque metaphors. We are not quite certain if this is conducive to easy comprehension, but it undoubtedly lends great charm to the

style. The references to authorities are singularly complete. Chapter xiii. on Island Peoples has no less than 223 separate citations, ranging from Aristotle to R. L. Stevenson. Very wisely the illustrations have been confined to maps, of which there are twenty-one. We do not like the hybrids, Sempacher *Lake*, Zuger *Lake*, in the Swiss Map on page 374, but this is the only blemish we have been able to detect, if one excepts the American spelling, which is a blemish only on this side of the Atlantic.

*Commercial Geography.* By Albert Perry Brigham. Boston, New York, Chicago, London: Ginn and Co., 1911. *Price* 6*s*.

It would scarcely be possible to set forth the essential facts of Commercial Geography more compactly than is done in this volume of 469 pages including index, with its clear orderly statement and its wealth of instructive illustration in the form of maps, diagrams and pictures. Even of these last very few could be pronounced mere pictures by the most critical, and some speak volumes, as, for instance, the pair on page 241 showing the difference made by the character of the road in the conveyance of raw cotton. The book is an addition to the number of those recently published primarily intended for use in the United States, to which country the whole of Part II. (276 out of 448 pages of text) is devoted. Even from a general point of view there is much advantage in this, since that vast country, with its great variety of climate and productions, gives so much scope for internal commerce, and hence facilitates the study of the influence of mere geographical factors apart from the disturbing effect of customs barriers and national bias. Very few errors have come under the notice of the present reviewer, but it may be pointed out that the diagram map of the production of rice in the United States on page 124, showing Texas to come next after Louisiana in the amount of that commodity produced, is not in agreement with one of the statements in the text on page 125, where South Carolina is said to come second, although lower down on the same page the text agrees with the map. On page 76 the Harz Mountains are mentioned as a convenient source of ores for the iron industry round Essen, from which district they are said to lie not far to the south-east. Apparently the Harz, which yields only trifling quantities of iron ore, has got confused with the Siegerland district, which does furnish important supplies, and actually lies, unlike the Harz, "not far to the south-east" of Essen. A few cases may be instanced in which modifications may be suggested for the consideration of the author. The comparison on pp. 114-15 between the physical structure of North America and Europe does not seem very instructive. Surely the fact that in both there is a great plain between great highland regions is of less geographical importance than the fact that the plains in the two continents have different directions. In the enumeration of the factors affecting the growth of centres of general industry on pp. 221-22 it would probably be better to reverse the order of 2 (facility of transportation) and 3 (importance of the hinterland) and to mention the former as involved in the latter, rather than the other way. For consider the admirable facilities for transportation in the Amazon basin and how unimportant any general centres of industry are there. Even the port of that basin was insignificant till the growing demand for rubber made the basin a hinterland. Further, the term hinterland is not merely unusual but inappropriate for inland trade centres serving, like Milan, Indianapolis, or Columbus, land lying all round. Seeing that one of the most valuable features of the book is the frequent illustration it affords of the modification of geographical values by the progress and application of invention, one may suggest that in future editions it

would be well to give the date of introduction of the self-binder (p. 7), as has been done in the case of some of the other inventions of cardinal importance. In view of this feature it is somewhat remarkable that in the brief but instructive account of the development of world commerce that forms the last chapter of the volume no notice is taken of the vital difference between the world-commerce of recent as compared with all past times made by the introduction of railways—of railways rather than steamships, for it was they that first afforded the means of collecting vast quantities of bulky produce from the far interior.

*Plant Life: A Text-Book of Botany for Schools and Colleges.* By Dr. Eug. Warming. With 250 Illustrations. London: Geo. Allen and Co., 1911. *Price* 4*s.* 6*d. net.*

This work is a translation from the fourth edition of the Danish, and will doubtless justify its existence as an elementary text-book for schools and colleges in this country. Throughout the book attention is paid to the "outdoor" aspect of the subject, but only one chapter—the last—is likely to be of any interest to a geographical reader. This summary of ecology contains a brief account of the principal plant formations found in Denmark, and as those of Britain agree on the whole with them, the chapter will form an introduction to English readers who may not have taken up this branch of botany. These formations are described under the following headings:—Saline Vegetation, Fresh-Water Vegetation, Heath Vegetation, Forest or Woodland Vegetation, and Field Vegetation.

*Peeps at Industries: Sugar.* By Edith A. Browne. London: Adam and Charles Black, 1911. *Price* 1*s.* 6*d. net.*

This is to be the first of a series of books devoted to the great industries of the world. The present volume contains a large amount of information in regard both to beet and cane sugar. To us the attempt to make the book "popular" seems to have resulted in the inclusion of a good deal of tedious and unnecessary matter, which might well have been omitted, but this is perhaps a matter of taste. It is illustrated by a fine series of plates from photographs.

## BOOKS RECEIVED.

*Burgundy: The Splendid Duchy. Studies and Sketches in South Burgundy.* By Percy Allen. Fully Illustrated with 8 Water-Colours and 86 Line Drawings by Miss Marjory Nush. Fcap. 4to. Pp. xix + 302. *Price* 12*s.* 6*d. net.* London: Francis Griffiths, 1912.

*Die Schwedische Südpolar-Expedition und ihre Geographische Tätigkeit.* Von Prof. Otto Nordenskjöld. Mit 3 Karten und 16 Tafeln. Demy 4to. Pp. 232. *Preis* 24 *Marks.* Stockholm: Lith. Institut des Generalstabs, 1912.

*Ruins of Desert Cathay. Personal Narrative of Explorations in Central Asia and Westernmost China.* By M. Aurel Stein. With numerous Illustrations, Colour Plates, Panoramas, and Maps from Original Surveys. In 2 volumes. Ry. 8vo. Vol. I. pp. xxxviii + 546. Vol. II. pp. xxi + 517. *Price* 42*s. net.* London: Macmillan and Co., Ltd., 1912.

*Engadine Year Book*, 1912. Second Year. A Record of the Sports and a Guide to the Resorts. Compiled by William W. Barton. Crown 8vo. Pp. xii + 216. *Price* 2*s.* 6*d.* London: Siegle and Co., Ltd., 1912.

*Map Projections in Actual Use.* By ARTHUR R. HINKS, M.A. Demy 8vo. Pp. 16. London: Published by "The Royal Engineer Journal," 1912.
Presented by Col. F. Bailey.

*Pequeño Atlas General de la República Argentina.* Por AQUILINO FERNÁNDEZ. Buenos Aires, 1909. Presented by Dr. W. S. Bruce.

*The Unvarying East: Modern Scenes and Ancient Scriptures.* By the Rev. E. J. HARDY, M.A. With 24 Illustrations. Demy 8vo. Pp. 287. *Price 7s. 6d. net.* London: T. Fisher Unwin, 1912.

*Blanket-Stiff, or a Wanderer in Canada,* 1911. By NORMAN NOEL. Fcap. 8vo. Pp. vii + 190. *Price 2s. net.* London: The St. Catherine Press, 1912.

*How Other People Live.* By H. CLIVE BARNARD, M.A., B.Litt. Containing 60 Illustrations, 32 of which are in Colour. 4to. Pp. 64. *Price 1s. 6d.* London: Adam and Charles Black, 1912.

*Hunters and Hunting in the Arctic.* By the DUKE OF ORLEANS. Translated by H. GRAHAM-RICHARDS. With 25 Illustrations. Demy 8vo. Pp. xxv + 204. *Price 7s. 6d. net.* London: David Nutt, 1911.

*Midlothian (Cambridge County Geographies).* By ALEX. M'CALLUM, M.A., LL.B. With Maps, Diagrams and Illustrations. Crown 8vo. Pp. x + 208. *Price 1s. 6d. net.* Cambridge: University Press, 1912.

*The Arctic Prairies: a Canoe Journey of 2000 Miles in search of the Caribou, being the Account of a Voyage to the Region north of Aylmer Lake.* By ERNEST THOMPSON SETON. Crown 8vo. Pp. xvi + 415. *Price 12s. 6d. net.* London: Constable and Co., Ltd., 1912.

*The True Temper of Empire, with Corollary Essays.* By Sir CHARLES BRUCE, G.C.M.G. Demy 8vo. Pp. vi + 211. *Price 5s. net.* London: Macmillan and Co., Ltd., 1912.

*Voyage à L'Ile Majorque.* Par JULES LECLERCQ. Avec 16 Gravures hors Texte et une Carte. Crown 8vo. Pp. 283. *Prix 4 Fr.* Paris: Plon-Nourrit et Cie, 1912.

*Practical Exercises in Map-Drawing.* By DOUGLAS WILSON JOHNSON. Crown 8vo. Pp. 20. Massachusetts: J. L. Hammett and Co., 1912.

*Nyasaland for the Hunter and Settler.* By D. D. LYELL. Illustrated with Photographs. Demy 8vo. Pp. vii + 103. *Price 5s. net.* London: Horace Cox, 1912.

*Sport in Vancouver and Newfoundland.* By Sir JOHN ROGERS, K.C.M.G., D.S.O., F.R.G.S. With Illustrations and Maps by the Author, and Reproductions of Photographs. Demy 8vo. Pp. xii + 275. *Price 7s. 6d. net.* London: Chapman and Hall, Ltd., 1912.

*The Tailed Head-Hunters of Nigeria. An Account of an Official's Seven Years' Experiences in the Northern Algerian Pagan Belt, and a Description of the Manners, Habits and Customs of the Native Tribes.* By Major A. J. N. TREMEARNE, B.A. (Cantab.), F.R.G.S., F.R.A.I. With 38 Illustrations and a Map. Demy 8vo. Pp. 342. *Price 16s. net.* London: Seeley, Service and Co., 1912.

*Through Timbuctu and across the Great Sahara. An Account of an Adventurous Journey of Exploration from Sierra Leone to the Source of the Niger, following its Course to the Bend at Gao, and thence across the Great Sahara to Algiers.* By Captain A. H. W. HAYWOOD, F.R.G.S. With 45 Illustrations and a Map. Demy 8vo. Pp. 349. *Price 16s. net.* London: Seeley, Service and Co., 1912.

*My Adventures among South Sea Cannibals. An Account of the Experiences and Adventures of a Government Official among the Natives of Oceania.* By DOUGLAS RANNIE. With 39 Illustrations and a Map. Demy 8vo. Pp. 314. *Price 16s. net.* London: Seeley, Service and Co., 1912.

*Among the Eskimos of Labrador. A Record of Five Years' close Intercourse with the Eskimo Tribes of Labrador.* By J. K. Hutton, M.B., Ch.B., F.R.G.S. With 47 Illustrations and 2 Maps. Demy 8vo. Pp. 344. *Price* 16s. *net.* London: Seeley, Service and Co., 1912.

*Siam: A Handbook of Practical, Commercial and Political Information.* By A. W. Graham, M.R.A.S. With 99 Illustrations and a Map. Crown 8vo. Pp. xiv + 637. *Price* 10s. 6*d. net.* London: Alexander Moring, Ltd., 1912.

*Report on the Control of the Aborigines in Formosa.* Demy 8vo. Pp. iv + 45. Taihoku, Formosa: Bureau of Aboriginal Affairs, 1912.

Presented by Rimpei Otsu.

*Report on the Department of the Naval Service for Fiscal Year ending March* 31, 1911. Ottawa, 1911.

*Memoirs of the Geological Survey, Scotland. The Geology of Knapdale, Jura and North Kintyre.* Explanation of Sheet 28, with Parts of 27 and 29. By B. N. Peach, LL.D., F.R.S.; the late J. S. G. Wilson; J. B. Hill, R.N.; E. B. Bailey, B.A., and G. W. Grabham, M.A. *Price* 3*s.* London: Board of Agriculture and Fisheries, 1912.

*Foreign Import Duties* 1911. *Statement of the Rates of Import Duties levied in European Countries, Egypt, the United States, Mexico, Argentina, Japan, China and Persia, upon the Produce and Manufactures of the United Kingdom. Price* 4*s.* 6*d.* London: His Majesty's Stationery Office, 1911.

*Sudan Almanack*, 1912. Compiled in the Intelligence Department, Cairo. *Price* 1*s.* London: His Majesty's Stationery Office, 1912.

*Mountains seen from Ben Cleuch.* By John E. Shearer, Stirling. 4to. *Price* 6*d.* Stirling: R. S. Shearer and Son, 1912.

*A Descriptive Catalogue of the Printed Maps of Wiltshire from* 1576 *to the publication of the* 25 *in Ordnance Survey*, 1885. By T. Chubb, of the Map Room, British Museum. Demy 8vo. Pp. 116.

*Statistical Abstract relating to British India from* 1900-1 *to* 1910-11. Forty-fifth Number. *Price* 1*s.* 3*d.* London: His Majesty's Stationery Office, 1912.

*Diplomatic and Consular Reports.*—Trade and Commerce of the Province of Arabistan, 1911 (4827); Trade of the Persian Caspian Provinces (Consular District of Resht and Asiarabad), 1911 (4828); Trade of the Consular District of Tangier, 1910 (4829); Trade and Commerce of Norway (Supplementary), 1910 (4830); Trade and Commerce of Ecuador, 1910 (4831).

*Colonial Reports (Miscellaneous).*—Imperial Institute. Selected Reports from the Scientific and Technical Department. Part iv. Rubber and Gutta Percha (82).

*Colonial Reports (Annual).*—Report for Northern Nigeria, 1910-11 (704). Report for East Africa Protectorate, 1910-11 (705).

*Publishers forwarding books for review will greatly oblige by marking the* price *in clear figures, especially in the case of foreign books.*

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Special enlargements from 1 : 2500 to 1 : 1250 Scale. Prepared for the Land Valuation Department, Inland Revenue. Price 2s. 6d. each. *Aberdeenshire.*—Sheets XXIII. 7 NW., SW. ; LXVI. 13 SW. *Kirkcudbrightshire.*—Sheet XLIII. 5 NW.

**GEOLOGICAL SURVEY OF SCOTLAND.**—The following publications were issued from 1st to 31st December 1911 :—

One-inch Map. New Series. Colour Printed, solid and drift editions. Sheet 28. Price 2s. 6d. The solid is shown in colour, the drift by symbols in black.

Memoirs of the Geological Survey. The geology of Knapdale, Jura and North Kintyre.—(Explanation of Sheet XXVIII., with parts of XXVII. and XXIX.) ; by B. N. Peach, LL.D., F.R.S., the late J. S. G. Wilson, J. B. Hill, R.N., E. B. Bailey, B.A., and G. W. Grabham, M.A. ; with notes by C. T. Clough, M.A., S. B. Wilkinson, W. B. Wright, B.A., and H. B. Maufe, B.A. ; and Petrological descriptions by J. S. Flett, M.A., D.Sc. Price 3s.

**GEOLOGICAL SURVEY OF SCOTLAND.**—Scale 1 : 63,000 or 1 inch to a mile. Sheet 28, *Jura.* 1911. Printed in colours. Price 2s. 6d. net.

*Presented by the Board of Agriculture and Fisheries.*

**EUROPE, INTERNATIONAL MAP.**—Scale 1 : 1,000,000 or 15·78 miles to an inch. Sheet North K 35, Istambul (Constantinople). 1912. Price 2s. net.
*Geographical Section, General Staff, London.*

This is the first sheet of the 1 : 1,000,000 International Map of Europe which has reached us. It is an excellent piece of cartography, well arranged, clear and legible, although perhaps the blue printing for hydrographic features is rather light and the brown contour lines rather strong and apt to be confused with the roads. Turkish spelling has been adhered to, but English equivalents of the principal places are also given. It is most creditable to the British War Office that they should have undertaken the mapping of Turkey in addition to that of our own extensive dominions.

## ASIA.

**CEYLON.**—Map of the Planting Districts showing the position of the principal Rubber, Tea, Cacao and Coffee Estates. Scale 3 miles to an inch.
*A. M. and J. Ferguson, Colombo.*

**CHINA.**—Atlas Universel de Géographie, commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader, No. 53, Chine (Asie en 10 feuilles, No. viii.). Échelle de 1 : 5,000,000. Prix 2 francs. 1911.
*Librairie Hachette et Cie, Paris.*

## AMERICA.

**ONTARIO AND QUEBEC.**—Topographic Map. Scale 1 : 63,360 or 1 mile to an inch. Sheet No. 28, Lachute. (Department of Mines and Defence, Ottawa.) Price 2s. net. *Geographical Section, General Staff, London.*

**CHILE.**—Mapa Escolar, Mandado hacer por orden del Señor Ministro de Instruccion Publica, Don Domingo Amunategui Solar, durante la presidencia del Ex^mo^ Señor Don Pedro Montt. Construido segun los ultimos datos jeograficos en la Inspeccion Jeneral de Jeografia i Minas de la Direccion de Obras Publicas. Injeniero jefe, Jose del C. Fuenzalida. Escala 1 : 1,000,000. 1911. *Presented by the Chilian Government.*

This large school wall map shows the orographical relief of the Andes with great effect. Political and other features are also clearly depicted.

**COLOMBIA.**—Mapa del Territorio de la Intendencia del Choco, en donde se encuentran y acimientos de platino y de oro. Escala 1 : 1,250,000.
*Presented by the Government of Colombia, Bogota.*

## AFRICA.

**AFRICA, INTERNATIONAL MAP.**—Scale 1 : 1,000,000 or 15·78 miles to an inch. Sheet H 34, Kenhardt. 1911. Price 2s. net.
*Geographical Section, General Staff, London.*

In this the first African sheet of the 1 : 1,000,000 International Map, it immediately strikes one that the part of German S. W. Africa is not completed in the same style as the Cape of Good Hope territory. It is also regrettable that this sheet is not uniform in style and treatment with the Con-

stantinople sheet also issued by the War Office. The names of mere farmhouses might with advantage have been in smaller type instead of being printed with as much prominence as small towns and villages in Europe.

**EAST AFRICAN PROTECTORATE.**—Scale 1 : 250,000 or about 4 miles to an inch. Sheet, Voi. Price 1s. 6d. net.

*Geographical Section, General Staff, London.*

**EAST AFRICAN PROTECTORATE.**—Scale 1 : 125,000 or about 2 miles to an inch. Sheet, Niandarawa. Price 2s. net.

*Geographical Section, General Staff, London.*

**KAMERUN.**—Karte in 20 Blätter und 4 Ansatzstücken im Massstabe von 1 : 300,000, bearbeitet von Max Moisel. Im Auftrage und mit Unterstützung des Reichs-Kolonialamts. 1911. Blatt G 3, Dume-Station ; Blatt H 3, Lomië. Price M. 2 each sheet.

*Dietrich Reimer (Ernst Vohsen), Berlin.*

**KAMERUN.**—Grosser Deutscher Kolonialatlas bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben von Reichs-Kolonialamt. 1911. Ergänzungs-Lieferung 3. Blätter—No. 3, Bauchi ; No. 5, Fumban ; No. 8, Lomië. Massstab 1 : 1,000,000. *Dietrich Reimer (Ernst Vohsen), Berlin.*

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## ATLASES, Etc.

**CITIZEN'S ATLAS OF THE WORLD.**—A Series of 156 pages of Maps and Plans, with an Index, a Gazetteer, and Geographical Statistics. Edited by J. G. Bartholomew, LL.D., F.R.G.S., Cartographer to the King. 1912. Price, cloth gilt, 25s. net, or half morocco, 35s. net.

*John Bartholomew and Co., Edinburgh.*

A 1912 edition of this well-known atlas. It aims at providing the general reader with a comprehensive set of reliable Reference Maps at a moderate price. The maps are clear and distinct, and revised to show the latest changes in Bengal, Morocco, Tripoli, the Congo, and other parts of the world. It may be commended as a generally serviceable atlas for the family library.

**OROGRAPHICAL ATLAS.**—A series of 32 coloured Maps. Price 6d.

*W. and A. K. Johnston, Limited, Edinburgh and London.*

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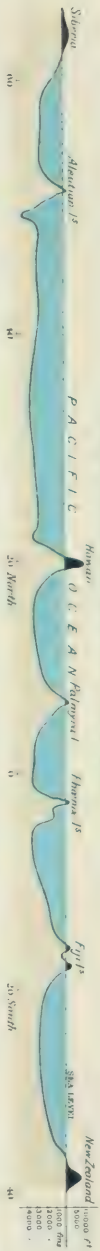
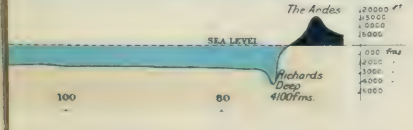



Fig. 3. SECTION ALONG LINE E–F



# BATHY-OROGRAPHICAL MAP OF THE PACIFIC OCEAN ILLUSTRATING PROF. GEIKIE'S PAPER

Fig. 1. SECTION ALONG LINE A–B

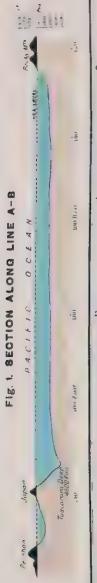
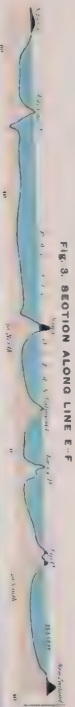



Fig. 3. SECTION ALONG LINE E–F



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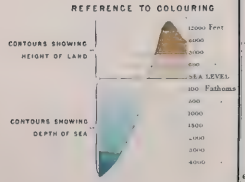
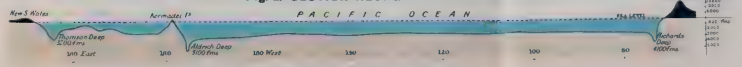



Fig. 2. SECTION ALONG LINE C–D




The Edinburgh Geographical Institute

Mr. J. Y. BUCHANAN, F.R.S.,
Gold Medallist of the Royal Scottish Geographical Society.

# THE SCOTTISH GEOGRAPHICAL MAGAZINE.

## IN AND AROUND THE MORTERATSCH GLACIER.[1] A STUDY[2] IN THE NATURAL HISTORY OF ICE.

By J. Y. Buchanan, F.R.S.

(*With Seven Plates.*)

My first acquaintance with the Swiss glaciers was made in the summer of the year 1867, on a short walking tour, which brought me, as it does most tourists, to Grindelwald. As a tourist I visited the lower glacier and penetrated into the artificial grotto, which was not illuminated: indeed it was so dark that though one heard the music of a zither, it was impossible to distinguish the person who played it. Possessing at the time no acquaintance with ice except such as is to be obtained from books, I learned very little from this visit. It is true that I saw a great deal, but I may say that I observed nothing the recollection of which I could take away with me. The ice-world was like a new planet to me, and my attitude towards it resembled that described by Forbes when, looking back after the completion of his famous work on the *Mer de Glace* in 1842 and the following years, he says :—

"I cannot now recall without some degree of shame the almost

[1] An address read before the Society in Edinburgh, by Dr. W. S. Bruce, on behalf of the author on January 24, 1912.

I wish to take this opportunity to thank Dr. Bruce for the readiness with which he undertook, at very short notice, to deliver my lecture when I was disabled by illness, and to congratulate him on the success with which he accomplished the task.—J. Y. B.

[2] Previous studies are to be found in the following :—"Some Observations on Sea-Water Ice" (*Proceedings of the Royal Society*, 1874, xxii. p. 431); "On Ice and Brines" (*Proceedings of the Royal Society of Edinburgh*, 1887, xiv. pp. 129-149, also in *Nature*, xxxv. p. 608, and xxxvi. p. 9); "Chemical and Physical Notes" (*Antarctic Manual*, 1901, pp. 73-108); "On Ice and its Natural History" (*Proceedings of the Royal Institution of Great Britain*, 1908, vol. xxix. pp. 243-276); "Beobachtungen über die Einwirkung der Strahlung auf das Gletschereis" (*Verhandlungen der Schweizerischen Naturforschenden Gesellschaft*, Basel, 1910, i. 330).

blindfold way in which until lately I was in the habit of visiting the glaciers. During three different previous summers I had visited the Mer de Glace, and during two of them, 1832 and 1839, I had traversed many miles of its surface: yet I failed to mark a thousand peculiarities of the most obvious kind or to speculate on their causes. . . . We are not aware in our ordinary researches in Physical Geography, or the natural sciences in general, how much we fall back on our general knowledge and habitual observations in pursuing any special line of inquiry, *or what would be our difficulty in entering as men upon the study of a world which we had not familiarly known as children.*"[1]

However, notwithstanding the unfamiliarity of the scene, I observed a good deal round about the glaciers, and I perfectly remember that the tongue of the glacier in which the grotto was driven was in the main valley immediately below the village of Grindelwald, and the same was the case with the upper glacier, the lower end of which protruded far into the Grindelwald valley. Both of these glaciers were in the average state which they had preserved during the previous hundred years, as could be ascertained from their representations in the albums of prints prepared for the use of tourists in the pre-photographic days.

These albums were got up with great care and often at great expense. The prints are generally beautifully executed, by well-known artists of the time, and their design is usually very true to nature. They seldom bear the date of their publication, because at that time views in Switzerland changed very little and a good album was expected to last through several generations of tourists.

In September 1909 I had the curiosity to re-visit Grindelwald, taking with me photographs of some of these prints, and I made it my business to find the positions from which the views had been taken, and from these I took photographs of the same views.

## Change in the Lower Grindelwald Glacier between 1777 and 1909.

Fig. 1 is a photograph of an illustration of the Lower Grindelwald glacier which was published in 1777.[2] Fig. 2 is a photograph taken by myself in September 1909 from the same spot from which the drawing for the engraving of 1777 was taken. The position of the church in both pictures gives a means of judging of the degree of coincidence of the two views. Although the present church is a different building from that which existed in 1777, both of them occupy the same site. The picture of 1777 represents the glacier as no more extensive or more voluminous than I remember it to have been in 1867.

The picture made in 1909 shows no ice in the main valley, nor is there any visible in the lateral valley until a considerable elevation is reached, and the source of the glacier in the *Eismeer* is not far distant.

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[1] *Travels through the Alps of Savoy, etc.*, by James D. Forbes, 1845, p. 59.

[2] *Tableaux Topographiques, etc., de la Suisse et de l'Italie.* Raoult: Paris. 1777. Volume i., plate No. 172. Drawn by Besson.

Two views of the Lower Grindelwald Glacier taken from the same position.

Fig. 1.—Engraved in 1777.
By recollection, the glacier was in this state in September 1867.

Fig. 2.—Photographed in September 1909.
The degree of coincidence of the views may be judged by the church which appears in both and necessarily occupies the same site.

Fig. 3.—From a print dating before 1856.

According to an engraving of 1777 it presented the same appearance at that date. According to recollection at least one-half of the lower glacier still existed in 1883.

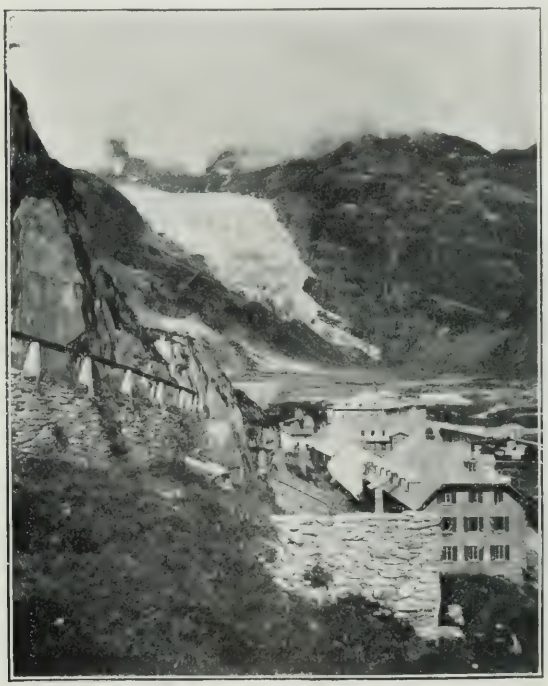

Fig. 4.—From a photograph taken in September 1909.

## Change in the Rhone Glacier since before 1856.

Fig. 3 is a photographic reproduction of the print of this glacier in an album entitled *Voyage Pittoresque de la Suisse*, published by H. F. Leuthold in Zurich. It bears no date, but the copy which I possess was brought from Switzerland in the autumn of 1856. The print of the Rhone glacier is signed by the artist *Bantli*, which may afford a clue to the date of the original sketch. In the work published in 1777, above mentioned, there is a picture of the same glacier, and both the extension and the volume of the glacier appear to be identical in the two pictures. Fig. 4 is from a photograph taken by myself in September 1909 on the spot close to the Grimsel road, whence the sketch for the print must have been taken.

When I passed by the Furka road for the first time, in 1883, the lower glacier, though already diminishing from year to year, still covered about one half of the area of the low ground which is shown to have been covered by it in the album. Now the lower glacier has disappeared entirely, and the ice fall is diminishing also. The word wastage hardly expresses the meaning: we are here face to face with devastation, and nearly the whole of it has taken place in no more than fifty years.

At the date of my visit to Grindelwald (1867) there was no idea of a period of continuous diminution of the glaciers being before us, nor did one fully realise it until many years later. There does not appear to be any record in historical times of a retreat of the Swiss glaciers such as we can witness at the present date.

It is very important to keep this fact in view when we read the works of the veterans of the first three fourths of last century and when we compare them with those to be found in modern literature. The old men, like Hugi, Agassiz, Forbes and even Tyndall, knew nothing of decaying glaciers.

Oscillations, no doubt, there were, but all these glaciers, in the main, held their own. Taking one year with another, the wastage of the summer was made good in the course of the year. These were the glaciers which they describe in their works, and if we compare them with equally faithful descriptions of glaciers in recent years, it is difficult to recognise that they refer to the same thing. If, as has been said above, the old men never saw a decaying glacier, it may be said with equal truth that none of the present generation of observers has ever seen a robust one.

M. Vallot, who has charge of the observatories of Mont Blanc, pointed out a few years ago that the sinking of the glaciers in the Chamounix district amounted then to fully one-eighth of the total amount of sinking since the last ice age.

But the recent shrinkage of the glaciers has taken place in fifty years; *therefore, at the same rate the whole shrinkage from the extension of the glaciers in the ice age to their present state may have taken place in four hundred years.*

M. Vallot [1] has also shown that the glaciers of the ice age, being at least 500 metres thicker than the present glaciers in the Chamounix district, must have travelled many times faster than the present ones do. Applying the formula derived from his work on the *Mer de Glace* to the case of the great glacier which in former times filled the valley of the Arve, he shows that, allowing it to have a total thickness of 1000 metres at its exit from the valley at Geneva, it may have had a rate of travel of 4·5 metres per day: that of the *Mer de Glace* at the present day is only 0·35 metres per day.

If the velocity of the ice radiating from the centre of snow and névé in the Alps at that spot was anything like 4 metres per day, and the thickness of it in the valleys was anything like 1000 metres, it is evident that when the decrease began, and the supply of snow and névé ceased to be able to feed a drain of ice from the mountains to the plains on the colossal scale which these figures indicate, the flow of ice would continue for a long time with very little abatement before the length of the glaciers would be much reduced. But as the supply at the fountain-head has been reduced, the persistence of the rate of flow of the glaciers must have the effect of stretching the ice in their upper reaches, and this would cause a diminution of their thickness without the necessity for melting to intervene. The melting, however, would proceed all the same, in proportion to the energy of insolation in the locality and to the superficial area of ice exposed to it.

The total effect of melting and stretching combined would be to accelerate the disappearance of the ice in the earlier part of the period of decrease, while the final rate of disappearance could not fall below that which it is at present.

Consequently, it may with certitude be affirmed that, when the ice of the ice age really began to disappear, the first half would do so at a greater rate than the second half, and that the time required for its reduction to a state such as that which it exhibited in the middle of last century may have been less than four hundred years.

## Shrinkage of the Morteratsch Glacier in the last few years.

The studies in and around the Morteratsch glacier which I have carried on continuously since the year 1906 enable me to illustrate the wastage of ice which this glacier has suffered in the years since that date. For this purpose I have chosen two photographs, Figs. 5 and 6, which represent the entrance to the grotto in September 1907 and 1911 respectively. The camera used was a 5″ × 4″ Kodak, and the exposures were made by hand, the camera being held in the ordinary way. Both photographs are taken from the same spot at an angle of the foot-path

[1] *Annales de l'Observatoire du Mont Blanc*, iv. 123.

VIEWS OF THE ENTRANCE OF THE MORTERATSCH GROTTO, BOTH TAKEN FROM THE SAME POSITION AND SHOWING THE SLOPE OF MUNT PERS BEHIND.

FIG. 5.—Photographed 17th September 1907.

FIG. 6.—Photographed 5th September 1911.

The wastage of ice due to superficial melting is shown by the increased exposure of the slope of Munt Pers. The lateral wastage is indicated by the perspective of the figures; and, by measurement, it amounted to 35·6 metres in the four years.

and 3·75 metres nearer the glacier than a rather dilapidated cairn or *Steinmannchen*. The comparison of these views shows well both the vertical shrinkage of the ice and the apparent horizontal retreat of this part of the western flank of the glacier. The latter strikes the eye at once by the perspective of the figures, and it has been confirmed by exact measurement. The vertical shrinkage in the interval between the autumns of 1907 and 1911 is shown in a striking way by the great increase of the amount of the slope of Munt Pers uncovered by the subsidence of the upper surface of the glacier owing to the liquefaction of its mass.

By far the greatest annual subsidence took place in the very hot summer of 1911, but in each of the years the loss was considerable. The average annual amount was from 2·5 to 3 metres and in the summer of 1911 it was between 4 and 5 metres.

The apparent horizontal retreat of the ice-foot under the centre of the grotto between the dates at which the two views were taken was 35·6 metres, or at the average rate of about nine metres annually. From this it is evident that the western flank of the glacier near its lower extremity has lost in each of these summers on an average a shell of ice 9 metres thick, while the maximum loss on the upper surface of the glacier has not been greater than 5 metres and the average not more than 3 metres. In summer the ice on the surface always receives a very full day's direct insolation: the ice on the flank receives very little, and that only in the afternoon. On the other hand, it is fully exposed to all the reflection and reverberation from the steep rocky slope which rises directly from the bottom of the valley and close to the ice-foot. It is, however, difficult to admit that this heat of low intensity can really be so much more efficacious in melting ice than the direct rays of the summer sun. A glance at the two photographs shows that the ice flank is very steep and faces westward. This position not only limits the amount of insolation which it can receive, it also affords it considerable protection against loss of heat by radiation into space. Every one knows that even on a hot summer day when the surface of the glacier is seamed by countless rills of running water and the sun-weathered ice-grains crumble beneath the boot, if the sun goes behind the mountains the fountain of the waters is closed almost immediately and the ice becomes hard and unyielding. Surface melting has ceased for the day. It is not impossible, but I have not checked this by observation, that the protection from cold which the flank enjoys may increase the amount of ice which it loses by melting in the year. But whatever may be the explanation, the distance, 35·6 metres, is exact. It depends on measurements made with the same 15-metre tape and involves no greater possible error than two or three centimetres. In September 1906 I fixed very exactly the position of the northernmost extremity of the glacier. In September 1909 I placed myself again exactly on the same spot, and found the ice face only 5 metres distant. *At the end of the glacier the rate of apparent annual retreat of the ice was less than 2 metres, while on its western flank it was nearly 9 metres.*

## Dependence of the Melting Temperature of Ice on the Nature of the Medium in which it Melts.

From observations which I made on sea ice in the Antarctic Ocean in the *Challenger*, which were followed up by researches in the laboratory after returning home, and from the study of much interesting work on the grain of the glacier then being done by Professor Forel of Lausanne, and others, I believed that my work on the lowering of the freezing point of water in the presence of even minute quantities of foreign matter dissolved in it, and the consequent depression of the melting point of pure ice when in contact with such water, would find a fruitful practical application in the study of the glaciers.

The account of these researches was published under the title, "On Ice and Brines," in the *Proceedings of the Royal Society of Edinburgh* for 1887.

The principle which guided this research was the following:—If the crystalline body which is formed when a non-saturated saline solution is partially frozen is pure ice, then pure ice of independent origin, such as snow, must, when mixed with the same saline solution, and heat is supplied, melt at the same temperature, when the concentration is the same.

The experiments undertaken with this end showed conclusively that the crystals formed by freezing a non-saturated saline solution are at least as free from salt as freshly fallen snow is, and that therefore the saline matter, from which they cannot in practice be freed, exists in solution and belongs to the adhering brine.

It was not until this had been established, in 1887, that it became legitimate to say: "The freezing point of *water* is lowered by the presence of salt dissolved in it," instead of saying: "The freezing point of a saline solution is so much lower than that of pure water."

The former of these statements expresses the fundamental principle of cryometric chemistry. . . . "In fact *the temperature at which ice melts in nature depends on the medium in which it melts as well as on the pressure to which it is subjected. If the pressure is constant, it varies with the nature of the medium; and, if the nature of the medium is constant, it varies with the pressure.*"

By a curious coincidence, the study of the freezing-point of saline and other solutions in very high dilution (infinite dilution was aimed at), was taken up at this time and prosecuted with great zeal by the rising pioneers of modern physical chemistry, and their labours furnished abundant material confirmatory of the conclusions at which I had arrived from my own experiments. The *Zeitschrift für Physikalische Chemie*, which was founded at this date (1887), is much occupied during the first eight or ten years of its existence by reports of researches and speculations in this field: one result of which was that the amount by which the freezing-point of water was lowered by the dissolution in it of a minute proportion of a salt was claimed as a trustworthy basis of arriving at the molecular weight of that salt.

The purest water occurring in nature is at the best only a dilute, but not an infinitely dilute, solution of foreign ingredients. It would naturally be expected that physicists and chemists who have made a study of land ice since the year 1887 would recognise not only the possibility but the certainty that the ice and the water which they meet with on glacier, névé, or snowfield, must, under constant conditions of pressure, melt and freeze at a temperature inferior to the melting and freezing point of pure $H_2O$.

We search their writings on this subject in vain for any recognition or application of this fundamental principle.

Explanations which ignore an important law of nature must be defective and may be misleading.

## The Source of the Impurity in the Intergranular Water.

The principal source of the impurity in the water which moistens the granular surfaces of ice, neve and snow is rock debris, which may take the form of stones, sand, dust or mud: and it is to be found everywhere, even in what is apparently clear ice.

This has often given me a great deal of trouble when photographing the ice of the walls of the grotto. In summer, when all the ice in the grotto is melting, its surface is contaminated with dirt, principally mud with some sand. When the outer superficial layer of the ice melts, the water runs away apparently quite clear, and the mud which has been liberated by the melting of the ice in which it was confined, seems by preference to remain adherent to the ice, partly as a fine semi-transparent layer and partly as small patches, perhaps of the size of a bean. If the surface of the ice be rubbed over with the hand it becomes completely obscured with the mud, and it costs some trouble to get it clean enough to be able to take a photograph through it. The mud is undoubtedly the product of the *kaolinisation* of the felspathic rocks of the neighbourhood, and the sand is some of the quartz which has been liberated by this purely chemical process of disintegration, which is accompanied by the production of carbonates and of other slightly soluble salts.[1]

It is never questioned that the water of a stream which in time of flood may have passed from the clouds over the soil into the stream bed in a few hours, has taken into solution some mineral matter, and river water is therefore always accepted as being *prima facie* impure. No one who has been placed in the situation of having to melt snow on the mountains to quench his thirst is likely to forget his dissatisfaction on discovering that the water produced was muddy. The sand and dust blown on to the surfaces of snow and névé get completely mixed up with the mass which, throughout a large part of the year, is in a constant state of alternate melting and freezing, and the mineral matter which thus becomes incorporated with the snow, névé and ice persists in this state at

[1] See Bischof, *Chemische und Physikalische Geologie*, Bd. i. Kap. i., vi.

any rate for many years. The certainty that some of it will pass into solution and influence the melting temperature of ice in contact with it cannot be contested.

### Usefulness of the Artificial Grottos, which are met with in all frequented Glaciers, for the Study of Glacier-Ice in its Primary State.

The motive which drove me in the first instance to visit the Swiss glaciers was to study the glacier-ice rather than the glaciers themselves. For this purpose it was necessary to have entry to the inner mass of the glacier. At first I confined myself to the natural cave or *Antrum*, from which the glacier stream proceeds, and left the artificial grotto maintained for the delectation of the summer visitors on one side. I had a feeling, which I imagine was not quite peculiar to myself, that the use of this pleasure-grotto for scientific purposes would be a little *infra dignitatem* of the student. However, one or two visits to it convinced me that the artificial grotto was the only place where the study of glacier-ice in its primary state was possible. Having arrived at this conviction, the economic reasons for the construction and the maintenance of the grotto troubled me no more. I reflected that if an astronomer can legitimately accept and use an observatory furnished by one millionaire, the humble student of glacier-ice may use as his laboratory the grotto maintained by the subscriptions of, it may be, a million tourists.

### Intergranular Melting of Ice and Freezing of Medium.

If the ice in the interior of the grotto in a glacier be studied in summer it will be perceived that melting does not take place exclusively at the surface; the interior of the ice appears to be wet also. The internal ice receives heat from without only by conduction, which suffices for the maintenance of intergranular moisture. The only other source from which it can obtain heat is the transformation of work. Helmholtz mentions this as a possible source of heat available for the fusion of ice in the interior of a glacier. He says[1]: "I should like here to direct attention to the fact that a not inconsiderable amount of heat due to friction must be produced in the larger glaciers. In fact calculation shows that when a mass of névé descends from the *Col du Géant* to the source of the *Arveyron*, it is possible for one-fourteenth part of it to be melted by the heat produced by the mechanical work."

The heat which can be obtained from both of the above sources is insufficient to produce any considerable liquefaction of the ice as a whole. Nevertheless the intergranular moisture is a very important item in the economy of the glacier. It is in fact the mother-liquor of the grain and provides the medium in which the activity of the crystallisation and dissolution of its ice develops itself.

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[1] *Populäre Vorträge.* Braunschweig: Vieweg, 1865, p. 133.

Every act of crystallisation in this medium furnishes crystals of ice and a mother-liquor. The impurity which was uniformly distributed in the original liquid is concentrated in the mother-liquor and eliminated from the crystal. The melting temperature of the pure ice when in contact with the mother-liquor is lower than it would be if in contact with absolutely pure water. It is this great natural law which secures the preferential melting at the intergranular surfaces. If the mass of the ice of two contiguous grains has exactly the temperature 0° C., and the liquid between the adjacent surfaces contains so much dissolved impurity as to reduce its freezing temperature to, say $-0{\cdot}001°$, then there is established a temperature gradient from the ice to the liquid which permits the ice actually in contact with the liquid to melt at the lower temperature, and at the expense of the heat in the mass of the grains. This example, if considered attentively, will show not only that, with the limited amount of heat available in the interior of a glacier, some melting must take place between the grains, but also that the total amount of ice so melted can never, at any one time, amount to very much. It is however enough to facilitate the flow of the ice in the dark: and, when the ice comes to the light, by its power of arresting certain of the solar rays, this liquid, even when very sparingly present, plays an important part, inasmuch as it serves to initiate or induce the differential action of the sun's rays, and exposes to their action in the interior of a mass of ice a working surface far greater than that furnished by its outer surface.

## Effect of Solar Radiation on Glacier-Ice.

*The principal effect of the action of the sun's rays on the glacier is the production of the white surface layer.* This has a thickness of from one to two metres, and, at a certain distance, it is only with difficulty distinguished from a surface of snow. Its whiteness is due to the same cause as is that of a field of snow, namely, discontinuity in the discrete masses of ice which compose the masses in both cases. The snow is produced and deposited in very fine crystals which press but lightly on each other and, when freshly fallen, it includes so much air that a measured volume of it when melted does not produce more than one-eighth or perhaps only one-tenth of the volume of water. The snow-field with its dazzling white surface is produced synthetically by deposition from the atmosphere. The nearly equally dazzling white surface of the glacier is produced analytically by the action of the sun's rays on blue glacier-ice. The blue glacier-ice has been produced out of the snow of the snow-field by coalescence, involving fusion and solidification under the control and direction of the laws of crystalline conformity. It is easily exposed by chipping away the outside layer at the surface of the glacier. If the blue surface so obtained is exposed to the sun's rays, it in a very short time shows a delicate etching, the lines of which represent the outcrop of the contiguous surfaces of the individual grains. These surfaces were already bathed with the intergranular liquid above referred to, which, by absorbing certain heat rays which

are transmitted by the ice of the solid grains, procures the heat which is then spent in the further melting of the contiguous ice surfaces. As the liquid which bathes these surfaces contains the greater part of the soluble impurities, pure ice, when in contact with it, melts at a lower temperature than that at which it melts when moistened with pure water. Therefore the internal melting of the ice of the glacier by radiant heat proceeds by the melting of the outside surface of each individual grain. In this way the grains in the immediate surface layer of the glacier rapidly get separated by gutters, by which the water of the melted ice is drained away, leaving the individual grains separated by air spaces. These have the same optical effect as those which separate the individual crystals of a mass of snow;—they produce whiteness. This rough surface of easily crushed grains is what enables the mountaineer to travel the glacier so easily. Were it possible, after the removal of the white outer layer and exposure of the blue ice, to submit this to the action of heat of convection alone, the ice would melt with a smooth surface, as can be observed on the inner walls of the grotto in summer. A glacier having such a surface would be barely passable. After the individual grains have been thus laid bare they themselves experience a further disintegrating effect under the continued action of the sun's rays, which is the same in kind as that produced on massive glacier-ice. As the sun's rays analyse a piece of glacier-ice, separating its constituent grains, so they continue the analytical process on the isolated grain or crystal, and separate it into its constituent lamellæ, which are situated normally to the principal axis of the crystal. Both of these analytical separations are due to the power of the sun's rays to detect the impurities which occur even in the purest crystal, and to eliminate them by discriminating fusion.

Having found that the whiteness of the ice on the surface of the glacier is a secondary feature and is due to its exposure to solar radiation, the question naturally arises, does white ice occur in the interior of the glacier? In order to answer this question it is necessary to be able to penetrate into the interior of the glacier.

## The Morteratsch Grotto.

As has been already indicated, the most convenient place to study such a subject is the interior of the artificial grotto, which is to be met with in all frequented glaciers.

The Morteratsch glacier is one of these: and at the date of my first visit, in the summer of 1893, there was a very fine grotto, driven in the western flank of the tongue of the glacier, which at that date extended more than a hundred metres further down the valley than it does now. I visited it almost daily, and at each visit I had the opportunity of observing phenomena which I did not expect. In the following February (1894) I returned to the Engadine in order for the first time to see a glacier and an ice-grotto in winter: the phenomena were still stranger to me than those that I had witnessed in summer: perhaps because the descrip-

tions of glacier-ice in winter were rare and not very informing. The glacier restaurant was but little frequented and no one visited the grotto, the entrance of which was snowed up. I had, however, very little difficulty in clearing a way into it, and I was astonished at the difference in its appearance as compared with that which it presented in the previous summer. The roof had sunk considerably and the pillars and longitudinal buttresses which supported it were much sheared in the direction of the entrance. There were also fewer air-bells in the ice than in summer, and the outer surface of the ice as well as the inner surface of the air-bells was dry: the temperature of the ice at a depth of three or four centimetres was − 4° C., which was also the temperature of the air in the grotto at the time. It must be remarked that, not being visited, *the grotto had been practically lying in darkness for some months, and the features of the ice in these circumstances would certainly be different from those encountered in summer, or in winter when it is continuously open to the light of day.*

In the summer of 1906 I began to use photography in my work, and it has naturally proved a great assistance. Since the above date I have visited the Morteratsch grotto at least twice, and in the last years four times in the year. *The critical dates for the glaciers, as for the seas and lakes, are the equinoxes and the solstices.*

## Granular Features of the Ice in Summer.

At the entrance of the grotto the ice is exposed partly to the direct rays of the sun and partly to its indirect radiation from the sky. Under these combined influences the ice at the entrance contracts the texture and general appearance of that on the upper surface of the glacier.

The occurrence of continuous white ice depends principally on the receipt of a considerable proportion of the whole radiation of the sky, so that the surface and the ice immediately below the surface may be disarticulated, and the water produced by melting may find, in the interstices so formed between the grains, gutters for efficient drainage. The proportion of radiation so received from the sky by the walls of the grotto diminishes rapidly as the distance from the entrance increases and the occurrence of continuous white ice diminishes at the same rate. At the entrance of the grotto it is only on the roof itself or in its immediate neighbourhood that continuous clear ice is to be seen, and this depends on the fact that these surfaces are by their position protected from direct radiation from the sky, and are exposed only to the much less powerful radiation of the ground in front of the grotto.

The delineation of the grain on the surface of the walls of the grotto ceases at a distance of four or five metres from the entrance. In certain places, however, where the ice is directly or normally exposed to the light from the entrance, the grain may be beautifully delineated on it, even though it may be half-way up the grotto. Fig. 9, from a

photograph made 19th September 1907, illustrates the revelation of the grain of the ice on the outer end of one of the ice-walls which receives direct daylight; this, however, is much subdued by the distance, about fifteen metres, of the ice-face from the entrance. This attenuated daylight acts like a very dilute acid in etching. The effect corresponding to the strong acid is the profound disintegration of the ice on the surface of the glacier produced by full exposure to the direct rays of the sun and the hemisphere of the sky.

## Granular Features of the Ice in Winter.

The winter visits were particularly interesting. The condition of the Morteratsch grotto turned out to be different in each of the last four winters in which I visited it. Fig. 7 represents it as photographed in January 1907. At that date the most striking as well as the most picturesque feature was the abundant deposit of rime or hoar-frost which penetrated into the innermost parts of the grotto. It covered the ice completely on the roof and on the walls down to a height of about 1·4 metres above the floor of the grotto where it ceased. Below this line it was completely absent. The deposit of hoar-frost was especially fine in the middle chamber of the grotto, shown in Fig. 7, where it furnished a wonderful picture of ice-flowers. In the galleries it was less abundant. It settled, as may be seen in Fig. 8, in the shell-like cavities of the roof as a comparatively thin coating and in great abundance on the sharp ice edges which separated these cavities. In these cavities the delineation of the grain of the ice produced by the condensation of the hoar-frost upon it was particularly beautiful. The phenomenon was not repeated in the three following winters, and I am not able to give a sufficient reason why it was so abundant in the one winter and was practically absent in the others.

It is to be remarked that in winter the ice of the walls of the grotto has a temperature below its melting point, it is hard and polished like glass, and its surface bears no delineation of the grain.

During this season such delineation is met with naturally in the interior of the grotto only as the result of the condensation of moisture as hoar-frost, and artificially in the immediate neighbourhood of the lamps used for illumination. Each of these lamps is a small local centre of disarticulation because it supplies not only the heat of convection which raises the temperature of the surface of the ice in its immediate neighbourhood to 0° C., but also the radiant energy which penetrates the surface and produces intergranular melting. The texture of the ice in immediate proximity to such a lamp simulates on a small scale that of the surface of the glacier which is due to the strong light of the sun. When I first visited the Morteratsch grotto only petroleum lamps were used, each of which melted a considerable dome out of the roof. Later these were replaced by acetylene lamps which produced greater wastage on the walls. Now the grotto is illuminated by electric incandescent lights which produce disarticulation but little melting.

THE MORTERATSCH GROTTO IN WINTER.

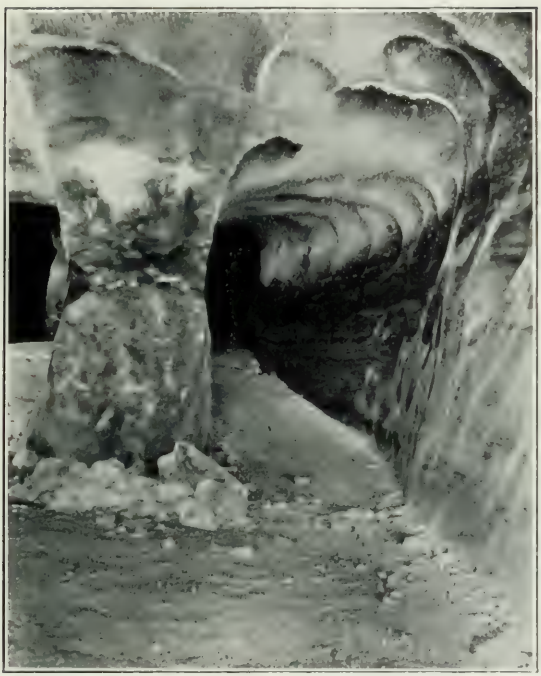

FIG. 7.—Taken on 16th January 1907.

Shows the great abundance of hoar-frost on the roof and its absence on the walls.

## Disintegration behind the Surface of the Walls.

For a distance of two or three metres from the entrance the superficial disintegration of the ice can easily be followed into its mass producing disarticulation of the grains and intergranular fusion along with contraction. In the study of this feature the stereoscopic camera is particularly useful. It renders services which are not to be obtained from the simple camera. A stereoscopic positive represents the ice exactly as *the two eyes* see it, and being permanent can be studied later. Moreover, there is often too little light in parts of the grotto for the eye to be able to see anything in the short exposure which suits it. The camera, whether stereoscopic or not, can be set up and exposed for any length of time which may be judged necessary in order to obtain a picture, and this, if stereoscopic, is all that is required for study.

The visible capillaries in the ice are tubes filled with vapour of water or air which lay themselves along the upper edges of the grains in the course of the intergranular melting of the ice. When these tubes become smaller and contract they often suffer segmentation and form a series of spherules.

If the external surface of the wall remains water tight we can have the case of a grain in the middle of the massive ice, which *floats* in the water of fusion which surrounds it. As a rule, however, the grains are so closely packed that the grain which would float is prevented, and, in place of doing so, is able only to exercise the corresponding pressure on the grain above it.

In the interior of the grotto the ice has on the whole a smooth surface and the discontinuities in the ice behind it, which proceed from the disintegration by radiation appear to be arranged more or less in layers. When a grain loses a superficial sheet of ice by melting, the water which appears occupies a smaller volume than did the ice which has disappeared, and the space vacated during the operation is occupied in the first instance by aqueous vapour of low pressure. If the ice-grain under consideration is situated near the surface of the wall of the grotto where disintegration is more advanced, the wall may not be water-tight and air penetrates easily into the space left vacant in the act of fusion, and we have really *air-bells*.

Let us imagine that the mass of ice consists of grains which are all of equal size and have the regular form of cubes. During intergranular fusion, a trough forms itself round each grain which is illuminated, and it is filled with water to the extent of nine-tenths of its volume, while the remaining tenth is filled with air or vapour.

If the cubes of an upper layer do not lie conformably on those of the lower layer, an apparent stratification is at once produced, and it would have a very regular character. But in the real glacier ice, as we meet with it in nature, the grains are quite irregular in form: and, in order that they may be capable of completely filling space, they must necessarily be of very different sizes. When radiation produces intergranular fusion in such a mass, the apparent stratification produced

must be irregular. This kind of stratification, crude though it may be, is always produced in the white surface layer of the glacier, and may be recognised in lines on the rough exterior of the glacier.

When the winter returns, the intergranular water which has accumulated during the summer begins to freeze so soon as the cold has begun to affect the inner walls of the grotto: but this takes some time, during which there is neither melting nor freezing in the grotto. When, however, it does begin to take effect, the outer surface of the wall of the grotto is cooled down below 0° C., and this temperature propagates itself into the mass of the ice as an isothermal surface, which may be considered a vertical plane. Isothermal planes corresponding to lower temperatures follow in its wake, and first the intergranular water freezes at a temperature which depends on its purity, leaving, however, always a relatively impure liquid nucleus often of microscopic dimensions. While the intergranular water is being frozen, it attaches itself to the grain in conformity with its crystalline orientation, so that the new ice added is not to be distinguished from the pre-existing ice of the grain. If there has been no leakage, then, when all the water has been frozen, there will remain only a cicatrix or scar which will contain the microscopic liquid nucleus consisting of brine of low freezing point. In the glass-blower's art we meet with scars of this class frequently. When two pieces of glass tube are joined together before the blowpipe, the joint is almost always characterised by a linear scar which, when examined under the microscope, is found to consist of a string of minute spheroidal discontinuities or air-bells. In the course of my work the most perfectly *healed* ice, or that in which the scar was least visible, was met with in the Morteratsch grotto in February 1894: but there, as we have already seen, the freezing and cicatrisation probably took place in the dark.

The features in winter are well shown in Figs. 10 and 11, which were photographed on 5th March 1910, while the winter still lasted. The ice-wall shown in Fig. 11 lies inside of that shown in Fig. 10, which it slightly overlaps. White ice in its interior is therefore less abundant than in the ice represented in Fig. 10, which is close to the entrance of the grotto. The forms assumed by the white ice in Fig. 10 are remarkable and unusual. As it was near the end of winter, the ice walls shown in these illustrations were frozen to a depth of several decimetres.

It is the custom for the proprietors of glacier grottos to have them repaired and enlarged every spring, so soon as the frost has come out of the ice. In the innermost part of the grotto, where the addition is always made, this happens very quickly, partly because the winter cold of the outside is much attenuated before it reaches the inner terminal chamber of the grotto, and partly because lights of one kind or another are maintained there for the benefit of sightseers, and this interferes with the cooling of the ice.

At the beginning of June 1910 I visited the new gallery which had been driven in the spring in ice which is far removed from external radiation, whether arriving by way of the galleries of the grotto or by

FIG. 8.—Shows the delineation of the grain in Winter by the condensation of moisture in the form of hoar-frost on the roof of the grotto.

FIG. 9.—Shows the revelation of the grain in Summer on a pillar in the interior of the grotto which received subdued daylight from the entrance.

Discontinuities which cause the appearance of White Ice in the walls of the Grotto in Winter.

Fig. 10.—Shows a very remarkable picture of these discontinuities in the north wall about two metres from the entrance.

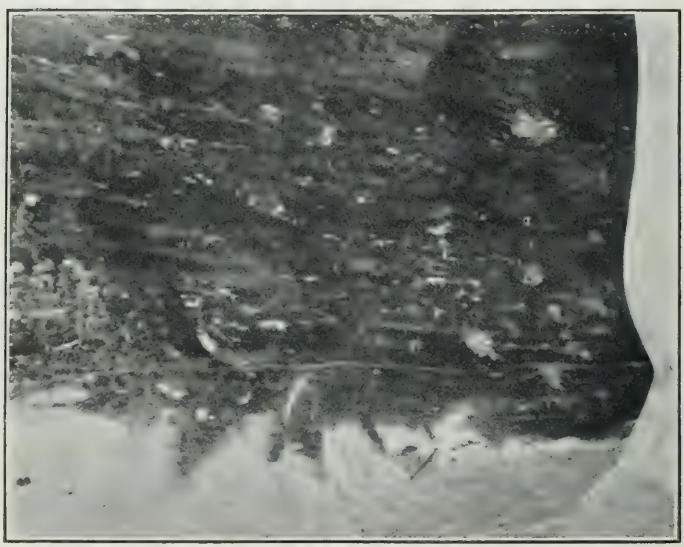

Fig. 11.—Overlaps Fig. 10 a little and shows the comparative absence of White Ice one or two metres further in.

transmission through the thickness of the ice above. I found the ice in general very free from air-bells. Only where the miner had struck the ice with his pick could one perceive bunches of white ice where the blow of the pick had produced dislocation of the grains. It was only at places on the wall from which the entrance of the grotto was directly visible, that the beginning of the secondary production of white ice could be perceived.

As the result of my observations in the artificial grotto, I have arrived at the view that *the discontinuities which are the characteristic of white ice may perhaps not be entirely absent in the interior of the glacier, because the ice is translucent, but that the white ice which is due to them is certainly not present in such proportion as to permit of its forming with the primary blue ice a ribbon-structure extending throughout the mass of the glacier.*

### The Case of a Glacier which has never been Exposed to Light.

Let us imagine that we have a glacier which has always existed in complete darkness. Were it possible to illuminate it for a moment it would appear as an intensely blue mountain. If the illumination were continued, the deep blue colour would quickly fade and before very long would be replaced by dazzling whiteness. Viewed in section the glacier would then appear as a blue internal mass contained in a white external wrapper. Indeed this is exactly the appearance which any of the existing glaciers would present if cut in two. An upper and lateral superficial layer, one to two metres thick, of white ice covering a mass of solid blue ice: it is the condition of equilibrium of a glacier on the surface of the earth. We cannot detect this when we merely look at a glacier from the outside. *It is only by penetrating into the inside of the glacier that we become aware that white ice is a secondary feature characteristic of the surface.*

While quarrying the ice of a glacier fresh surfaces are continually being exposed, which, in proportion as they are exposed to the daylight, begin to change their colour from blue to white. It might be thought that we are thereby placed on the horns of the dilemma,—if we wish to see if there is white ice in the inside of the glacier we must illuminate the ice; but if blue ice is sufficiently illuminated it becomes white ice: therefore the experiment is not decisive. But the sun-weathering of fresh ice demands time, whereas the human eye, if prepared, can decide whether ice is blue or white in a moment of time. When a fresh ice surface is about to be exposed it is of the greatest importance that the observer be on the spot: but this usually depends on luck.

### Water a Protective Medium, Opaque to the Rays which Disintegrate Glacier Ice.

There is, however, another way of arriving at the condition of ice which is protected from the disintegrating effect of radiation, namely,

to enclose the mass of ice to be examined as completely as possible in a medium which is opaque to, or transmits only feebly the rays which produce the granular disarticulation of ice. *Such a medium is water.*

The polar seas, especially those of the southern hemisphere, are crowded with icebergs. When they are of recent origin they are of tabular form and cover a surface of many square kilometres.

In this condition they resemble flat boards which, when they float on their sides, have great stability. But in the course of time they begin to get dilapidated and to break up into smaller units which may arrive at the state in which their horizontal and vertical dimensions differ little from each other. Such a berg is about as stable in one position as in another: in other words it is unstable. Any loss of substance can bring about a disturbance of equilibrium which may cause the berg to turn partially or completely over before it finds a new position of equilibrium. The spectator who has the luck to assist at an act of this kind, sees before him an intensely blue berg floating in the sea surrounded by countless white bergs. On the *Challenger* we had this good fortune. On one of those wonderfully beautifully days of the Antarctic summer the ship was engaged in the work of a "station," surrounded by icebergs of the usual form and appearance. By the shifting of the position of the ship or by an independent alteration of the grouping of the bergs, a deep blue berg suddenly appeared amongst the others. The colour was pure ultramarine, and nothing white, whether as patches or layers, was visible. The weather being very fine, work was continued all day in sight of this beautiful and striking object which excited the admiration and the curiosity of every one on board. When the work was done the ship steamed round the blue berg and found its other side white: so that the original berg had only half turned over. If, therefore, the ship had been working during the whole of the day on the other side of the berg this marvellous object would have been close to her without being seen, and indeed without the possibility of the existence of such an object being suspected. It was a piece of extraordinary luck. None who saw the berg ever forgot it.

To any one who is familiar with the ice conditions of the Antarctic it is evident that an event of this kind must be rare. As it is also very seldom that a ship finds itself in these latitudes, it must be a still greater rarity for a freshly-capsized iceberg to come under human eyes.

### The Mergelin See and its Icebergs.

It would hardly be expected that anything similar could occur in European, and still less in Swiss, waters. Yet, something perfectly similar, differing only with regard to size and depth of colour, may be seen in any summer in a small but famous lake in Switzerland, namely the *Mergelin See*, which is confined in its little valley by the Aletsch glacier, which closes its outlet. This glacier is continually shedding portions of its substance which then float about in the lake, giving

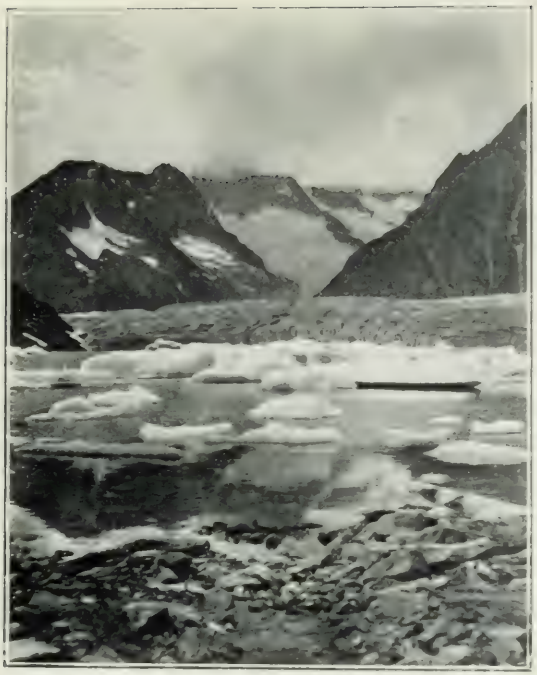

Fig. 12. The Mergelin See.

The waters are retained by the ice of the Aletsch Glacier from which small icebergs are frequently detached.

Fig. 13.—On the Morteratsch Glacier.

an exhibition in miniature of the colossal icebergs which crowd the waters of the Antarctic Ocean.

The shore of this lake (Fig. 12) is the best place that I know of for studying the natural history of glacier-ice. The bergs and smaller lumps of ice which float in it may go through all the possible metamorphoses of glacier ice in the course of a single mid-summer day with a powerful sun. I have spent many days in this study on its banks and nothing could be more fascinating. The best season for this work is early in July, because in this investigation the physical agency used is the energy of the sun's radiation. This reaches a maximum at noon on the date of the summer solstice, 21st June, but for quite a month on each side of this date there is hardly any diminution, either of the sun's meridian altitude or of the length of the day, and these are the factors which determine its power of doing work. Consequently the early part of July is quite as good as any date in June; moreover, before the beginning of July there is no hotel accommodation on the mountain, and the observer must make his visits to the lake from Fiesch or other station in the Rhone valley.

While studying the bergs and other fragments of the glacier ice stranded on the margin of the lake, I noticed that the bergs which were afloat were seldom at rest, and this was particularly remarked on days when the sun was most powerful. On observing more closely the bergs which exhibited this unrest I saw that it was accompanied by subdivision of their mass and alteration of their equilibrium. This act is called "calving" by the whale fishers and causes one of the principal risks to their ships if they approach the icebergs too closely. In the waters frequented by whalers the calving of the glaciers is not an everyday occurrence. On the *Morteratsch See* where the mass of even the largest berg is comparatively small, this act can be observed frequently on a hot day. If it be attentively observed it will be found, if the "calf," the portion of ice which has been shed by the berg, comes, as it usually does, from the part of the berg under water, that it is quite transparent and has a perfectly smooth surface. If the parent berg be now observed, it will be found that it has altered its "trim." This alteration of trim may amount to only a slight "list" or it may assume the dimensions of a complete capsize. As a rule the alteration of trim is considerable, and the alteration which it produces in the appearance of the berg is due to the submergence of a part of the ice having the rough dead-white granular appearance acquired by continued exposure in air to the direct rays of the sun, and to the emergence of a part of the ice possessing a smooth surface and perfect transparency, properties which it was able to preserve in spite of the apparently perfect freedom with which the sun's light penetrates the water and renders visible to the eye the submerged features of the berg. From this it follows necessarily that the particular rays which bring about the disintegration of the glacier ice are absorbed by water, while, on the other hand, they are transmitted abundantly by ice.

Even the largest berg in the *Morteratsch See* is a very small object compared with the blue berg seen in the Antarctic, and with its insignifi-

cant mass the proper colour of its ice is much attenuated: it is represented by a delicate bluish tint.

*We see then that equal protection is afforded to the ice from the disintegrating rays of the sun by the fresh water of an Alpine lake and by the salt water of the ocean. Naturally the water can afford this protection to the ice only by absorbing these rays itself, and in doing so it must be warmed correspondingly.*

## Hugi's Fundamental Experiments.

We now have the information which enables us to follow in detail and to explain the capital experiment first made by Hugi in the year 1822.

When a piece of fresh glacier ice is fetched from the *Antrum* or the grotto, or from some place inside the glacier where the ice is protected from radiation from the sky, and is then exposed to the rays of a powerful sun, in a very short time it crumbles together and falls into a heap of individual glacier-grains.

We have seen that the ice in the interior of the glacier is always at the melting point of the ice on the intergranular surfaces, which is influenced by the relative purity or impurity of the water occupying the intergranular spaces. As the purity of the ice-crystal which remains solid is always greater than that of the water in contact with it, the mass of the grain is protected by the lower temperature at which its superficial layers melt. But no matter what the melting temperature may be, no melting takes place without an adequate supply of heat.

The fresh piece of glacier-ice, which we imagine to have been fetched from the *Antrum*, is a piece of the internal ice of the glacier, inasmuch as it has not been exposed to the direct action of sky light. We have seen that the amount of heat, small though it be, which is transmitted through the ice by conduction, or which may be generated by the transformation of work, is sufficient to keep the internal ice of the glacier always wet. But this moisture is not promiscuously diffused through the mass of the ice: it is strictly localised and confined to the interstitial spaces separating the individual grains. When the piece of ice is exposed to the sun's rays, this intergranular water, which, chemically speaking, is the *mother-liquor of the grains*, interrupts the passage of the rays and acts upon them in the same way as does the water of lakes or seas. It absorbs the disintegrating rays which are allowed to pass by the solid crystalline ice, and these provide the equivalent amount of heat in the water, which, being everywhere in contact with the grain-surfaces, melts the equivalent amount of ice. A lump of ice of such size that a person can carry it without difficulty, after exposure to a powerful sun for from twenty to thirty minutes, appropriates out of the rays passing through it sufficient heat to produce in its interior so much intergranular fusion that the whole lump gets disarticulated and is resolved into its individual grains before the mass itself has suffered sensible diminution of bulk.

If we attempt to make the experiment on a warm summer day

when the sky is overcast with clouds, the disarticulating effect produced by the diffused sky-light is insignificant, and the lump of glacier ice will melt as a whole, preserving its smooth exterior surface, although the form of the individual grains may be delineated, because the intergranular surfaces, being in contact with relatively impure water, will melt at a lower temperature. Consequently the smooth melting surface of the block will always exhibit a channelled delineation of the grains, although it may melt completely without falling into grains. If the sky, without being completely overcast, is cloudy, and the temperature of the air comparatively high, the rate of melting as a whole may be so great that the lump may melt away by the outside before the amount of radiation available has been able to supply sufficient heat to the interior to produce the intergranular fusion which permits complete disintegration.

In very cold winter weather, when the temperature of the air is continuously below the melting temperature of ice, exposure to the sun disarticulates the grains as perfectly as it does in summer. But so long as the temperature of the ice remains below the freezing temperature the grains hold together. The appearance of the lump shows that it has been in fact disarticulated. The moment its temperature reaches 0° C. disintegration takes place, and the lump becomes a heap of grains without there having been any melting. Hugi's experiments in this direction are classical. They were made during his *Wanderreise ins Eismeer* in January 1832, a date which marks one of the most important epochs in the development of our knowledge of the natural history of ice.

## Recapitulation.

A glacier is a granular crystalline mass of ice which, in summer, is throughout at its melting temperature. In winter it has the same temperature, with the exception of a superficial shell of small thickness, which follows the atmospheric changes of temperature, subject to some retardation of epochs. It does not, however, begin to do so until the atmospheric changes have proceeded so far that the surface of the glacier is cooled below its melting temperature, and this epoch is affected by the date when the glacier receives its winter covering of snow.

The granular surfaces are moistened with water derived from the ice of the grain. This liquid contains the greater part of the soluble impurities derived from the rock-débris which is intimately mixed with the ice. In contact with it the melting temperature of the ice is lowered, independently of any alteration of pressure. But the supply of heat available for melting ice in the interior of the glacier is very small: consequently very little of it melts. What does melt, however, is sufficient to maintain everywhere a liquid nucleus between the grains. This compact but granular mass is *the primary ice of the glacier, its colour is blue, and it persists unaltered in obscurity.*

Among the rays emitted by the sun, there are some which are

absorbed by water with production of heat, although they are transmitted abundantly and without alteration by ice. When the primary ice is exposed to the sun, these rays penetrate its mass and are absorbed by the intergranular liquid, the temperature of which would be raised, but, as it is contained in a space bounded by two parallel and almost contiguous surfaces of ice, the rise of temperature is checked and an equivalent amount of ice is melted instead.

When a volume of ice is melted, its place is taken to the extent of ninety per cent. by liquid water, and to the extent of ten per cent. by gaseous water of very low pressure. The latter strikes the eye as a discontinuity in the ice: such discontinuities, when present in adequate proportion in a transparent substance, produce the impression of whiteness.

We have seen that such discontinuities are found in the artificial grotto. When the ice-wall in which they have been developed is at the entrance of the grotto, or not more than about two metres distant from it, the disintegration produced by the radiation from the sky is so considerable that the ice-wall does not remain water-tight, and not only does the ten per cent. gaseous discontinuity fill itself with air, and for the moment become really an air-ball, but the air continues to enter, and permits the ninety per cent. of water to run out, when the hundred per cent. replacement of the volume of ice by air is achieved. In this way the apparent discontinuity caused by the direct effect of radiation in the intergranular spaces has been increased ninefold by its indirect effect in bringing about drainage by destroying the staunchness of the ice-wall and causing it to leak. By our studies in the artificial grotto it has thus been established, not only that the drainage caused by the thoroughness of the disintegration of the ice exposed to the full light of day is a dominant feature of the ice within a distance of a couple of metres from the external surface of the glacier, but also that the leakiness of the ice-wall ceases almost abruptly at this distance from the entrance, so that, except in the immediate vicinity of lamps, or where the ice has been exposed to recent mechanical disturbance, the walls of the grotto are practically water-tight.

When the surface of primary ice exposed to the daylight has been obtained by clearing away the rough white ice from an area of the upper surface of the glacier, the transformations which have just been described take place very quickly.

The arched surface of the glacier facilitates drainage, and the melting of the ice on the granular surfaces enlarges the interstices between the grains, so that through them the water escapes as soon as it is produced. In the course of a day or two, according to the intensity of insolation, the compact-layer of blue primary ice becomes converted into a disconnected, easily crumbling layer of white ice, which is not distinguishable from that of the undisturbed surface of the glacier. Consequently—*the white ice which forms the outside layer of every glacier is a secondary formation, and is derived from the primary blue ice of the interior by the process of sun-weathering, that is, by disintegration under the influence of solar radiation.*

As the discontinuities which produce white ice are dependent on

solar action, it is unlikely that they can be present in the interior of the glacier in such proportion as to permit of their forming with the primary blue ice *a ribbon-structure* throughout the mass of the glacier, as is frequently postulated. This is borne out by the observations made during a series of years in the interior of the Morteratsch Glacier.

If the water of the intergranular spaces, which is present in the primary ice in so small a quantity compared with the mass of the ice which contains it, is able, by absorbing the disintegrating rays, to melt the ice of the grain, it must, when present in large quantity, *protect the ice immersed in it from this action*. This is proved by the behaviour of icebergs in the sea-water of the Antarctic Ocean, and in the fresh water of the Mergelin See.

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## JOURNEY THROUGH A PORTION OF SOUTH-EASTERN TIBET AND THE MISHMI HILLS.

By Captain F. M. Bailey.

*(With Map and Illustrations.)*

The following account of a journey through a small unsurveyed portion of south-eastern Tibet and the Mishmi Hills may be of interest in view of the military and political measures recently taken in consequence of the murder of Mr. Williamson and Dr. Gregorson by the Abors.

I travelled out by the Siberian railway, and, after being detained for a week in quarantine, on account of the plague which was raging in Manchuria, reached Peking on March 8, 1911. Having spent a week in the capital, and obtained a passport, I took the train to Hankau, where it was necessary to wait for some days before an up-river steamer left for Ichang. From Ichang I passed up through the Yangtse gorges, about which so much has been written, in company with Mr. Hill of the Chinese Customs, who shared a house-boat with me for this part of the journey; unfortunately, we were wrecked in one of the rapids, and obliged to pass the night in the open. On reaching Wan-Hsien, I spent two days with Mr. and Mrs. Ortolani of the Imperial Post Office, while making preparations for my 400-mile journey to Chengtu. At Chengtu I enjoyed the hospitality of Mr. Wilkinson, H.B.M.'s Consul-General, for a few days before continuing my journey. At Ya-Cheou I called on one of the large firms engaged in the Tibetan tea trade, and saw coarse tea-bricks being made. At Tachienlu, where the first Tibetans were met with, I sent back a useless Chinese servant who had accompanied me from Peking, and took in his place a Tibetan, who remained with me until I was about to enter the Mishmi country.

From Tachienlu I made an excursion in search of Takin (*Budorcas taxicolor*) to a place some fifteen miles to the south, crossing a pass called

Boi la (13,240 feet), which on May 14 was covered with snow about a foot deep. From here some very distant snow mountains were visible to the south and to the south-west, the latter range being somewhat the nearer of the two. Below the pass I saw some magnificent yellow poppies, one of which measured six and a half inches in diameter. I was unsuccessful in my search for Takin, though many tracks some months old were visible. On this trip I saw game birds of many kinds: snipe, woodcock, and pheasants of five varieties, as well as partridges and two varieties of snowcock[1]; there was also a large bird, called *Cha na* in Tibetan and *Huo tan chi* in Chinese, which lives at the snow-line, but I was unable to get a view of it and could not shoot a specimen. Besides

Fig. 1.—Tachienlu.

tracks of Takin, I found those of serow and musk-deer, and close to Tachienlu I saw three stags which had been taken in the neighbourhood and were kept in captivity. It was said that there were burhel (*Ovis nahura*) on the Boi La To (pass), but, though I spent a day in the search, I did not succeed in finding them. I left Tachienlu finally on May 19, and in five marches reached Ho-kou, or Nyachuka as it is called in Tibetan, where I found a French engineer, M. Kerihuel, engaged in building a suspension bridge over the Yalung river. The next place of importance on the road was Litang, where, by invitation, I stayed in the large lamasery. On June 2 I arrived at Batang, where I was the guest of Mr. and Mrs. Edgar, of the China Inland Mission; and here I was able to obtain cash from a merchant for a cheque on Shanghai.

[1] See footnote 1 on page 202.

In company with Mr. Edgar I left Batang on June 6, and was fortunate in having as a companion a man who is not only a keen traveller and observer but has a thorough knowledge of both the Chinese and the Tibetan languages, and whose familiarity with the conditions on this frontier is unsurpassed.

Our first objective was Yenching on the Mekong. In some villages on the road we visited schools in which Tibetan children were being taught by Chinese schoolmasters. Such schools have been opened wherever twenty pupils can be collected, and attendance is compulsory for children living near them. Outside the school-house were some simple

Fig. 2.—Nomad women outside their tent, near Batang.

gymnastic appliances, and a time-table with a list of rules was posted on the door. The subjects taught were geography, history, literature, reading, Chinese, recitation, arithmetic, hygiene, drawing, singing, drill, and science; while the rules for conduct in school were the following: "Don't whisper; don't eat; don't fight; don't speak Tibetan; don't recite '*om mani padme hum*' or other prayers; don't carry knives; don't be dirty; don't dirty the desks." Boys and girls were in separate class-rooms, and the ages of the pupils, who were all doing the same work, varied between four years and twenty; they worked for five hours a day on six days a week.

Chinese influence is making itself felt to a considerable extent in the borderland, as is evidenced by these schools. An attempt is also being made to change the Tibetan names of places and to substitute Chinese

names: these latter are in some cases a translation of the Tibetan word, but sometimes they are merely a rough transliteration. The people are bound to take Chinese personal names, which so far are only being used by the Chinese in the law courts, but it is hoped that, eventually, they may entirely supplant the Tibetan ones. A list of suitable Chinese names has been drawn up, and each Tibetan can choose whichever of them takes his fancy.

On passing Pamutang a few days after leaving Batang, we made a slight detour and crossed the Tibetan frontier by the Ning Ching Shan or Po La, a pass where the Tibetans used to maintain a guard of soldiers. From this pass we saw three distant snow-peaks to the south-west. The pass being unoccupied, we went down to the village of Lanteng (or Lhamdun), where we found a party of Chinese soldiers on the march from Chiamdo. We boiled a thermometer here, and obtained an altitude of 12,727 feet. We recrossed the frontier into China the same day. On June 10 we crossed the Kia La (14,894 feet), from which pass we had a view of the hills across the Mekong, but the top of the range was in cloud. Opposite to us we could see the lamasery of Lagong, approached by the very steep zigzag path up which we were to travel the next day. It was late when we reached Yenching, and as we were anxious to cross the bridge at once, we passed the town on our left hand, and descended through the steep valley which separates the plateau of Yenching from that of Yerkalo, where there is a French mission station. On reaching the bank of the Mekong, we went a few hundred yards down stream to the rope bridge, which we crossed, and then put up in the village of Jada close to the salt wells. The river was swift, very muddy, and of a reddish colour. As the result of a hypsometrical observation, we found the altitude of the Mekong at the bridge to be 7300 feet. Yenching is known in Tibetan as Tsaka, both names indicating that salt is found here. The next morning we went to see the wells. The brine is collected in circular pools about 2 feet deep and 3 or 4 yards in diameter. From these it is taken in birch bark buckets and poured into other and shallower pools underneath drying pans made of earth spread on wooden platforms, which in the distance look like the flat roofs of a large village. Here it is left till, some of the water having evaporated, it becomes stronger. This brine is then poured into the drying pans. The sun beating upon these evaporates all the water, leaving a thin layer of white salt, which is then swept up with a broom; but a good deal of red earth from the pans is mixed with it, and this gives the salt a dirty reddish appearance. It was at this bridge that Major Davis and his companions were turned back in 1900; the lamas fired on the party and eventually cut the rope bridge. These hostile monks came from the lamasery of Lagong, which we passed through the next day. It had been sacked by the Chinese in 1907, and at the time of our visit was in charge of a small guard of Chinese soldiers.

Having successfully passed Yenching, we decided to make for Menkong, on the Salween. We left the Mekong on June 11. On our second day's march we crossed the watershed between the Mekong and the Salween at the Beda La (15,209 feet). There was aconite

on the pass, and our transport ponies were therefore muzzled, but we passed an unfortunate man whose pony had eaten the poisonous plant and was dying. He begged us to help him, but we could do nothing, and later in the day he overtook us, his animal having died.

There are said to be stags in the forest near here, but I saw only two gooral. The road up the Beda La was through a forest of fir and pine in which were many beautiful rhododendrons, the lower ones had mauve flowers, while higher up the flowers were white: there were also apricot-trees bearing unripe fruit. After crossing the pass, we stopped in the large village of Petu, which M. Bacot had previously visited. This village, with a few outlying farms, has about one hundred inhabitants, besides a lamasery of fifty monks. Our small room was invaded by a friendly crowd of both monks and laymen, to whom Mr. Edgar gave tracts which those able to read devoured with great interest: they frequently tie them along with Tibetan prayers to bridges, or to trees near water or their houses. The women wear a quantity of cheap jewellery. The houses in this neighbourhood are roofed with pine shingles kept in position by heavy stones, while the houses at Yenching, those at Wabo further down the Drayul Chu, and also those in the Salween valley at Menkong, have the usual flat Tibetan terraced roofs. The Drayul Chu flows past the Yenchin village: it was crossed by A. K. at Drayul Gompa, some three days' journey further north, and he describes it as being 60 paces wide and 3 feet deep. At Petu it cannot be more than 30 yards wide, and this is also the width at a bridge three miles further down-stream, but the depth must be considerably more than 3 feet. This river, as we shall see, performs some wonderful geographical gymnastics before it finally falls into the Salween. Like all rivers of any size in this part of the world, it receives a different name every few miles. At Petu the soil yields two crops a year.

After leaving Petu, we crossed a pass, the Tong La (10,797 feet), only to find ourselves again in the valley of the Drayul Chu, which makes a long bend to the south, and again a smaller loop which we could see in front of us. From the Tong La, distant snows were visible to the south and south-west. Before reaching the village of Wabo, we could see the junction of the Drayul Chu with that of the Salween, though we could not see the actual streams at the bottom of the deep valleys. The country here has a bare, arid appearance, but the tops of the hills show signs of a damper climate, being covered with fir and pine forest: lower down is a thick belt of prickly oak, and below that again a small thorny scrub. There are many villages in which crops of barley were being cut, water being brought from the hills in log troughs. The hills are very steep. At the point where we left the Drayul Chu the river issues from a precipitous gorge, and turns sharply to the north. At the village of Ke, a few miles from this bend, it is about 30 yards wide, and 7480 feet above sea-level. I obtained a specimen of a snake[1] near the village of Ke. On leaving the Drayul Chu we crossed the Tondu La (11,240 feet). As we ascended, we passed through the damper

[1] Identified by Mr. George A. Boulenger as *Coluber taeniurus*.

zone, where we found the dry-looking shrubs giving place to firs, pines, birches, and rhododendrons, while the ground below them was carpeted with ferns. Our view from the pass to the north was interrupted by the forest through which we had just passed, but that to the south was very striking. The Salween could be seen flowing almost due south, hemmed in by high hills, bare at the base but with a belt of forest higher up, while on the summits were patches of snow with an occasional up-standing snow peak. Spurs came down from the ranges on either side, and the river twisted among these. A few villages could be seen on the banks of the Salween, and the valley running to the river from the pass on which we were standing was well cultivated. After descending steeply from the pass, we reached the village of Lonbo, where we spent the night. The people here were thrashing corn with flails. The next day we were obliged to make a small diversion from the main road to Menkong in order to change our transport animals at the village of Trana. At this point the Salween flows west, but at Trana it takes a turn to the south. The hills are precipitous, with scanty dry vegetation, among which a cactus-like plant, with an orange-coloured flower, was conspicuous.[1] The Salween is a swift, muddy river, very similar to the Mekong at Yenching. We crossed by a rope bridge, and found the altitude of the river-bed to be 6056 feet. It is here called the Gyamo Ngo Chu. A steep climb of 1000 feet from the bridge brought us to the village of Menkong, where we found a small garrison of Chinese soldiers. Apricot and pomegranate trees were growing in the village. Here we found the Tibetans keeping slaves of some race of very small stature (men about 4 ft. 8 in.; women about 4 ft. 4 in.); they were said to have come from a country which the Tibetans call Tsong, seven days to the south of Menkong. They did not know anything of their own history, they could speak no language but Tibetan, and wore Tibetan dress. They were well treated by their masters. One of the female slaves had a tattooed face. On first reaching Menkong the Chinese found among the slaves some Chinese whom they liberated, but they allowed the Tibetans to retain slaves who were not Chinese. A mile from Menkong there is a lamasery with about sixty monks, but we were unable to spare time to see it. I was anxious to take an observation for latitude at Menkong, but cloudy weather prevented my doing so. From here Mr. Edgar returned to Batang by the route we had followed thus far together, and I was not to see a white face again until I reached Sadiya. I was sorry to lose my companion, whose experience of travel in the country and knowledge of Chinese were invaluable.

My road lay up the bank of a tributary which joins the Salween at Menkong. There were extraordinarily large numbers of butterflies here, almost all of one species (*Neope agrestis*). A steep ascent brought me to a pass, the No La (14,128 feet). The weather was very cloudy, and I could not see much of the surrounding country, but caught a

[1] Professor Balfour thinks that this is probably a Euphorbia, perhaps *E. antiquorum*.

glimpse of snow-mountains to the east. After crossing the range, I found that the streams flowed to a river in a valley lying north-east and south-west. I was unable to determine with accuracy in which direction this river flows: but I think it most probable that it is towards the south-west to join the Irrawaddy, and that it does not flow into the Salween. The next day, June 17, I had to cross a higher pass, the Tsema La (15,676 feet). On this there was a good deal of soft snow, which caused some trouble to my ponies. The hills around the pass are steep and rocky, the hollows being filled with snow. The weather was cloudy, but I got a brief view of distant snows to the north-west. This pass is closed in winter for animals, but men can always cross it over the snow. After descending from this pass, and following a stream for some miles, I reached a river some 20 yards wide: this is an upper branch of the Irrawaddy. I asked whether the water did not flow into the Salween, and was told that it did not, but that it went to a country called Lhoka or Tsong. Here the valley of the Irrawaddy is about 11,500 feet above sea-level. The tops of the hills are grassy, with outcrop of rock, below which is a belt of fir forest, while the bottom of the valley is open grass, on which many ponies and cattle were grazing. There were a few belts of firs or junipers across the grassy valley. I noticed clematis in flower on these trees, and collected some specimens of Cypripedium orchids (*C. luteo* and *C. tibeticum*). The few habitations are very poor rough huts with roofs of pine shingles, and a few fields are occasionally met with, but the crops are uncertain. I heard the call of the large white pheasant (*Crossoptilon*), but did not see the bird. The saddle-cloth commonly used here is a burhel skin, these animals being found on the surrounding hills. On June 18 I stopped at the village of Lagyap, whence I noticed a snow-peak at the head of a valley to the north. I was told that a place called Gula is situated in this valley. After marching for two days up the Irrawaddy, I came to the foot of a pass, the Tsong La, where I found a circular lake about 150 yards in diameter, to which a border of rhododendrons gave quite an artificial appearance: I shot a partridge, and noticed both blue and yellow poppies. The main branch of the river I had followed for the last two days was here only about a yard wide, and took its rise in the snow-covered hills to the north of the pass. The Tsong La, which was found by hypsometer to be 14,913 feet high, was clear of snow, though there were some drifts on the roadside. The water west of the Tsong La joins with a stream which flows due south, and must be the headwaters of the Tara Wan, which passing through Kamti Long joins the Irrawaddy.

At the Zhasha La, a pass 15,711 feet above the sea, which I crossed on June 20, I left the Irrawaddy basin and entered that of the Zayul Chu. On the pass there was very little snow actually on the road. After crossing it, the road follows down the open valley of a stream which, after about 8 miles, enters a gorge and eventually joins a larger stream at a village called Michi (11,937 feet). This is the place which A. K. visited on April 21, 1882, giving it the name of Rika, which is the name of one of the houses: the village is sometimes called Michi-Rika, but Michi is the commoner name, and I did not hear A. K.'s name for the place until I

had made inquiries about it. There are some hot springs here, in one of which I bathed, the temperature being 115° where the water issued from the ground. My next day's march to Drowa Gompa was along the road followed by A. K. twenty-nine years previously. At about six miles from Michi I noticed a considerable stream bursting from the hill-side on the left bank of the river. Drowa Gompa (8746 feet) is a large village of log huts with roofs of shingles held down by stones. The people about here, and to some extent at Menkong, wear an under-jacket of blue cloth edged with red, which gives it the appearance of a kind of uniform. They carry knives in sheaths of wood, one side being open and the knife held in leather thongs, much as do several of the tribes in the Eastern Himalayas; I once bought a sword in a sheath like this from a Mohammedan who was passing through Tibet on his way from Central Asia to Mecca. The people of south-eastern Tibet carry primitive chopsticks formed of a single splinter of bamboo bent double and kept in the sheath with the knife. These people are great snuff-takers. The snuff-box of south-eastern Tibet is of a peculiar kind; a small circular wooden box has a piece of cloth stretched tightly across the mouth, on the top of which the lid fits; the box is turned upside down and given several sharp taps, which force some of the snuff through the cloth into the lid: this is then removed and the snuff is taken from it. In his table of population A. K. states that there is one lamasery of fifty monks, and twenty-five houses with only five inhabitants; I quite expected that this last statement had been made in error, but I found that, as usual, he was right, and that there were many empty houses. The lamasery now only supports fifteen monks. Finding the people here very friendly, I proposed going to Sangachu Dzong, and to this they raised no objection. In this and several other villages I was asked if it was a fact that we were ruled by a woman, and whether it was true that in my country women had much more power than men, who were always obliged to walk, while women were allowed to ride horses.

The road to Sangachu Dzong passes up the Zayul Chu in a northerly direction. At Drowa Gompa the river was about 30 yards wide, the water being muddy and of a grey colour. After going up for some miles, I reached a place where the stream narrowed to about seven yards and flowed partly under the overhanging rocky bank. Here the road crossed to the right bank of the river by a single-span log bridge. At one point a road up a branch of the river leads to a place called Trong-yu. On the left bank, at about 13 miles from Drowa Gompa, there is a fine precipice with a sheer drop of about 1500 feet. The river was a foaming mass of dirty water the whole way from Drowa Gompa. There are very few villages. The regular stage, at which I stopped on my return journey, is Loma, famous for the wooden bowls which its inhabitants make. Here I saw potatoes growing, and a kind of *dal*, called in Tibetan *Sanchu*, besides barley and peas. The people wished me to go to a place four days' journey to the east, where they said that stags and burhel, with other kinds of game, were very plentiful, but I had not time to do this. As one approaches Sangachu Dzong, the road passes through thin forests of fine

pine-trees in which parroquets [1] were nesting. Near Sangachu Dzong the valley opens out, and there are many scattered farmhouses with much cultivation. This place is called Goschen; and Sangachu Dzong, a large group of houses, can be seen on a spur four miles to the west. Goschen must be a healthy place, to judge by the number of old people who sit on the roofs of the houses turning prayer-wheels; one intelligent old man told me that he was eighty-two, and had made a pilgrimage to Lhasa sixty years ago. I noticed the horn of a barbel on the roof of a house—the first tangible evidence of the presence of this animal that I had seen for some time. On June 24, at the invitation of the monks, I moved over to Sangachu Dzong, traversing the intervening four miles over a plateau covered with scrub, through which two branches of the Zayul Chu cut ravines 500 feet deep. On arrival at Sangachu Dzong I found a crowd of monks, all anxious to get their first sight of a white man. I was housed in a fine brick building close to the monastery. The dzong was deserted and in ruins, as were most of the other houses, but the lamasery was in good repair. There were about seventy monks. In the absence of the abbot, the head monk sent some of the monastery officials to me with a teapot of buttered tea and some boiled rice. I paid a visit to the lamasery, where I was given a meal. There were some fine images in the temple, and a particularly striking row of *chortens* beautifully ornamented. I also saw two copies of the *Tun Jur* and one of the *Kun Jur*, which had been printed at Netang, near Shigatse. In return for their politeness I sent them a photograph of the Dalai Lama, and on my return journey I added one of the Tashi Lama. The valley to the west of Sangachu Dzong is well cultivated, and many brick-built farmhouses with roofs of shingles are seen dotted about: the population within a radius of 5 miles cannot number less than five hundred. The river which flows at the base of the spur on which the houses are situated is called the Tsilung Chu. On the most recent maps Sangachu Dzong, of which I found the altitude to be 11,693 feet, is placed on a tributary of the Salween, but this is incorrect. The Tibetan Jongpen, who rules this part of the country under the Lhasa Government, had left on account of the arrival of the Chinese. Some months previously he had sent one of his stewards to meet the late Mr. Williamson at Rima: and Mr. Williamson had given this man some Indian tea, which was not used, but was being kept by the monks as a curiosity, and some advertisement sheets of the *Pioneer* in which it had been wrapt formed treasures which I was asked to explain. The distance from Sangachu Dzong to Lhasa is covered in from twenty to thirty-two days.

On June 26 I left Sangachu Dzong. The road passed up the valley of the Tsilung Chu. The bottom of this valley is cultivated for about five miles up-stream, while the hills are covered with a forest of firs, birches and poplars. Opposite the village of Dendon, up a valley to the south-west, I saw a glacier with, as I thought, a stream flowing from it, but I was afterwards to find out that this stream breaks through the range in a surprising manner. The day after leaving Sangachu Dzong

[1] See footnote 1 on page 202.

I crossed the Jo La, a pass 16,307 feet above the sea. This was the first day of clear weather since my departure from Batang. For about half a mile there was deep, soft snow, over which my ponies struggled with great difficulty. Looking back from the pass, I could clearly see Sangachu Dzong and the farmhouses of Goschen, and I also had a view for many miles down the valley of the Zayul Chu up which I had travelled. The valleys were all thickly wooded, and the tops of the more distant hills were rocky, with some snow, while those which were nearer to me, and from which several small glaciers emerged, were covered with snow, except where the rocks were too steep to retain it. Owing to the lie of the ground, I could not see anything to the north-west, but after crossing the snow I had a good view. In that direction the country presented an appearance very different from that of the country which I had left: and it was at once evident that its climate is much drier, as the hills were bare of all vegetation except grass and very small shrubs. A stream was seen flowing in a broad open valley. As I was on the top of a high snowy range, I naturally thought that this stream rose in the range, and was flowing away from me to the NW.: but, on reaching it, I was surprised to find it flowing towards me, and was told that it breaks through the range and comes out at the village of Dendon, where I had previously seen it. On leaving the pass I observed some large snowfields and peaks, quite near, to the south and south-west, and saw the stream flowing into a gorge among rocks, snows, and glaciers. It would be interesting to follow its course through the hills, where some remarkable scenery would be met with, but there is no road. The altitude of the point where the stream enters the gorge must be about 15,000 feet. Some miles from the pass another surprise greeted me, for I came on a small sluggish stream flowing north-west. There is a very flat watershed between the Nagong Chu, which flows past Shiuden Gompa, and the Tsailung Chu branch of the Zayul Chu, which flows past Sangachu Dzong. After following this small stream for a short distance, I found that it was reinforced by water from a valley to the south in which there are three glaciers. I camped in a cave which can be recognised by the smoke-blackened entrance. Just before this, a valley from the north leads to the Dama La, over which lies an alternative route from Sangachu Dzong, used only when the Jo La is closed by snow. The bottom of the valley here was two miles wide and covered with brushwood, in which there were a great many hares and partridges: I also caught many butterflies, including three species of *Colias*, and saw a pair of ruddy sheldrakes and some redshanks, which were breeding. Near the Jo La there were also many marmots, one of which was caught by a dog which had attached itself to me. Here I noticed a blue poppy.[1] I continued on down this valley, which gradually got wider and more broken until I was descending through low hills with a few scattered firs and juniper-trees, among which hares swarmed. Finally, I came in sight of the Ngamtso. This is a lake about four miles long by one mile wide, narrowing at one part, over which the

[1] Identified by Prof. Balfour as *Meconopsis rudis*, Prain, var. *Prattii*.

bridge described by A. K. has been built. The lake is very shallow at the southern end. On the flats which border it are many fields and some farmhouses, while Shiuden Gompa, a cluster of buildings, is on a hill 400 feet above the water and 13,685 feet above sea-level. I went up to the gompa, and was met by a dirty goitre-stricken monk, who combined the duties of head of the lamasery with those of the civil officer of the district of Nagong. From the gompa a large and dirty glacier can be seen descending to the southern end of the lake. The road to the Ata Gang La passes the glacier, and it was by this road that A. K. travelled when he came to Shiuden Gompa after turning back from Rima. Above the lake is a high rocky conical peak. The river which leaves the lake here flows to the west, but I was unable to find out for certain whether it joins the Tsang Po or turns southward to India before reaching that river. In fact, the country between Shiuden Gompa and the Tsang Po is so wild and disturbed that the people of Nagong, the district of which Shiuden Gompa is the capital, never visit it. The women in this part of the country wear a single large turquoise set in silver on the hair, which is plaited in a queue.

I visited the monastery, which holds about seventy monks. It is similar to that at Sangachu Dzong, but not quite so fine. The official would only allow me to go in one of two specified directions: I could either go to Chiamdo or return by the way I had come: and I decided to return, as I wished to be back in India by the end of July. Here I succeeded in taking an observation for latitude, and found it to be 29° 28′ 7″. On reaching a stream on my return journey, I was dismayed to find one of my mule drivers above his waist in glacier water, trying to recover a crumpled mass which I recognised as the water-tight tin box containing my small collection of bird skins. There was another box lying in the water, which did not concern me so much. For several days I did my best to dry the skins which, though rather bedraggled, I hoped were not altogether spoilt: the accident was caused by a pony falling off a rickety bridge. Passing Drowa Gompa again on July 3, I arrived the same evening at Chikung, where I found a Chinese garrison of soldiers under an officer. We exchanged visits, and he was most friendly, treating me to a bottle of champagne. The soldiers besieged me for medicine, of which I distributed some quantity, treating each case according to the instructions in "Hints to Travellers": I sincerely hope that no harm resulted.

The road I followed on this and the two following days down to Rima was that along which A. K. had travelled in 1882. I found an Indian slave with the Chinese at Chikung. He had been captured by the Mishmis, who sold him to the Tibetans, but the Chinese had released him: I offered to take him with me to India, but he would not come. The road from Drowa Gompa to Rima follows the Zayul Chu. There is very little cultivation, though the soil appears to be adapted for it. At one point, opposite to the village of Dabla, there is a fine, almost sheer face of rock, standing up about 1000 feet above the left bank of the stream. The roadway is very bad: in places galleries are built

round the cliffs, and in others sticks have been fixed horizontally across the smooth rocks to give ponies a foothold. Near Rima the valley widens out considerably, and a large river, the Rong To Chu, joins the Zayul Chu from the north-west. The combined river is called the Ngo Chu by the Tibetans. About a mile north of Rima is the village of Shika. This used to be the headquarters of the Tibetan officials, while Rima was the village in which the local peasants lived. I saw many rice-fields here, and also maize, while apricot-trees were bearing unripe fruit: there were a few Chinese soldiers who had grown various Chinese vegetables successfully.

I reached Rima on July 5. I was much disappointed to find that boots were unknown here, as I had hoped to be able to replace mine, which were quite worn out. I took two observations for altitude with the hypsometer, and found it to be 4839 feet; A. K. made it 4650 feet. Snow falls here in winter; the temperature in the shade was 91° at 4 P.M., and in a very open room by a window the minimum was 71° at night. The inhabitants of Rima are different from those of the other parts of south-eastern Tibet through which I had just passed. They cut their hair short and do not wear a queue; elsewhere in south-eastern Tibet the people never smoke, though they take quantities of snuff, but at Rima tobacco is both grown and smoked. The inhabitants of Rima are very much cut off from the rest of Tibet: they never make the usual pilgrimage to Lhasa or other holy places, and, although professedly Buddhists, are very lax in their religion: when I was in pursuit of Takin I saw a man sacrificing a fowl in order to bring him luck. The form of marriage among them is that "by capture": the bridegroom goes with his friends to the house of the bride, where the men of both parties quarrel and fight for a time; the quarrel is then made up, all feast together, and the couple are considered to be man and wife. I had noticed that the people of Sangachu Dzong and at several other places wore coats made of the skins of gooral of a foxy-red colour, which were said to come from the neighbourhood of Rima. I made inquiries about this, and was told that these animals were plentiful in the hills down-stream from Rima.

One day's march down the river brought me to Kahap, which is called "Kanau" on the R.G.S. map of Tibet. Mosquitoes and biting flies were troublesome here. Ponies cannot travel on the road down from Rima, as in many places the track climbs over cliffs and up notched logs, near which a rope of creepers is usually fastened to help the traveller. From Kahap I went two days' journey into the hills to the east over awful roads, and here found a hot spring where a herd of about three hundred Takin (*Budorcas taxicolor*) come every night and morning to drink. I returned to Kahap after having shot six of them. At one place in this valley I crossed drifts of old dirty snow at an altitude of less than 10,000 feet. A pass at the head of this valley, between 30 and 40 miles from Kahap, leads to a country which the Tibetans call Cho, where a people similar to the Mishmis live. From Kahap I marched to Tin-ne, where a rope bridge spans the Lohit River. The river was about 80 yards wide, and very rapid and muddy. At Tin-ne I met some Mishmis, from whom

I heard for the first time of the murder of Mr. Williamson and Dr. Gregorson. Plantains and tobacco were grown at this village.

From Tin-ne I travelled down the Lohit, passing through the Mishmi country. At a village called Krang, about 22 miles below the great bend in the river, I lost my compass, and was therefore obliged to discontinue the route survey which I had kept up since leaving Yensing on the Mekong river. The Mishmis are great smokers; their pipes are of bamboo, the tobacco being grown locally and dried in the sun: they also smoke a great deal of opium, which is mixed with sacking and smoked in a roughly made bamboo pipe. The Mishmi carries a flint and steel somewhat similar to that used by the Tibetans; pine torches afford his only artificial light, and towards the end of our marches my coolies used to search among the drift-wood on the river bank for a log of resinous pine from which to make them. The chief article of food in the country is maize, but I also got a few sweet potatoes and unripe plantains, which, when cooked, are quite an eatable vegetable. Every evening a mist about fifty feet thick used to hang above the water, and when the road dropped into this, I noticed a fall in temperature, while on rising out of it I felt as though entering a hot-house. I reached Tashalun, the Mishmi village nearest to the Indian frontier, on July 29. Here, to my disappointment, I found that the usual road to Sadiya was impassable owing to the swollen condition of the river, and that I should be obliged to cut my way through the jungle at the foot of the hills where the streams were smaller. I spent a day in this village, as the coolies had to prepare food for several days in advance. The chief house of the village was a very long narrow bamboo building, raised about four feet from the ground, and divided into cubicles in each of which one family lived. A fire was lit in the middle of each cubicle, and three long logs, which met in the fire, were gradually moved in as they burnt away, the parts of them lying across the room being used as pillows. Some of the Mishmi villages further into the hills were surrounded by a bamboo palisade with sharpened spikes on the door. The Mishmis cover the walls of their houses with the skulls of cattle and other animals: the house in which I stopped at Tashalun showed over seventy such skulls, all, with one exception—a deer—being those of domestic animals. Eight days' travelling from Tashalun brought me to Sadiya. I was obliged to cut through a virgin forest for most of the way, and to ford many rivers: but sometimes my Mishmi coolies would fell a tree to bridge a small deep river. At one place I only made a quarter of a mile after cutting through the jungle for an hour and a half. Leeches were very troublesome: I have never seen them worse. I saw tracks of many varieties of game, including elephant and buffalo, and at one of my camps in the hills the coolies asked me to sleep with my rifle at hand, as they had heard a tiger prowling round. On my last day's journey into Sadiya, I voyaged down the river in a narrow dug-out canoe. At Sadiya I was the guest of Mr. Dundas and Captain and Mrs. Robertson.

Goitre is a very common disease all over south-eastern Tibet, and is not uncommon among the Mishmis. At the time of year at which I was travelling, the weather was most unfavourable for survey work. Clouds

nearly always obscured the higher hilltops, and rain fell frequently, while in winter many of the passes are closed by snow. Consequently, this must always be a difficult country to survey. In July and August the minimum temperatures at night in the Mishmi country varied between 61° and 76°. I found the Mishmis difficult to manage, but, luckily, had some opium with me, for which drug a Mishmi will do a great deal. I carried no tent, but in Tibet I usually slept in a house, and in the Mishmi hills the people rigged me up shelters of plantain leaves. A word in praise is due to my Tibetan servant Putamdu, who, having on my summons gone down to Calcutta, had been shipped out to China by Thomas Cook,

FIG. 3.—The Wongi La (14,560 feet), between Nyachuka and Litang. Reading the boiling point.

and accompanied me throughout my journey from Peking to Sadiya. I brought back a small collection of about sixty skins of birds,[1] with the eggs of several species, and the skins of a few small mammals.[2] I had

[1] Mr. Ogilvie Grant says that special mention may be made of the rare Koslow's Scimitar-Babbler (*Babax Koslowi*), and a small brownish Warbler or Chiff-Chaff, believed to be *Phylloscopus Homeyeri*, neither of which species was represented in the Natural History Museum. Other rare species are Lord Derby's Parroquet (*Palæormis derbyensis*), and Széchenyi's Pheasant Grouse (*Petrœophasis Szechenyii*), with other game birds. Among these last he has identified five pheasants (*Crossoptilon thibetanum*, *Thaumalea amherstiae*, *Phasianus elegans*, *Ithagenes geoffroyi*, and a Tragopan: a partridge (*Perdix sifanica*); and a snowcock (*Tetraogallus tibetanus*).

[2] Mr. Oldfield Thomas states that two of the mammals proved to be new—a mole-rat (*Myospalax*), and a mouse-hare (*Ochotona*). These have been named respectively *M. baileyi* and *O roylii chinensis*.

also about two thousand specimens of butterflies,[1] besides two hundred moths and a few other insects.

The latitude of Shiuden Gompa was determined with a 6-inch sextant, and all heights were taken by hypsometer. I am indebted to the Royal Geographical Society for the loan of these instruments, and to the Survey of India for their kindness in working out the results of my observations.

I add an itinerary of my march from Wan-Hsien, on the Yangtse, to Sadiya:—

| Marches. | Dates. | Days. | | Miles. |
|---|---|---|---|---|
| | | Marching. | Halting. | |
| Wan-Hsien to Chengtu, | 9 to 22 April | 14 | | 400 |
| Halt at Chengtu, | 23 to 26 April | | 4 | — |
| Chengtu to Tachienlu, | 27 April to 9 May | 13 | | 255 |
| Halt at or near Tachienlu, | 10 to 18 May | | 9 | — |
| Tachienlu to Ho-Kou or Nyachuka, | 19 to 23 May | 5 | | 80 |
| Halt at Ho-Kou, | 24 May | | 1 | |
| Ho-Kou to Litang, | 25 to 28 May | 4 | | 80 |
| Litang to Batang, | 29 May to 2 June | 5 | | 145 |
| Total, Wan-Hsien to Batang, | 9 April to 2 June | 41 | 14 | 960 |
| Halt at Batang, | 3 to 5 June | — | 3 | |
| Batang to Menkong, | 6 to 15 June | 10 | | 174 |
| Menkong to Drowa Gompa, | 16 to 21 June | 6 | | 93 |
| Drowa Gompa to Shiuden Gompa, | 22 to 27 June | 6 | | 80 |
| Halt at Shiuden Gompa, | 28 June | | 1 | |
| Shiuden Gompa to Rima, | 29 June to 5 July | 7 | | 123 |
| Halt at Rima, | 6 July | — | 1 | |
| Rima to Sadiya, | 7 July to 7 August | 28 | 4 | 285 |
| Total from Batang to Sadiya, | 3 June to 7 August | 57 | 9 | 755 |
| Grand Total from Wan-Hsien to Sadiya, | 9 April to 7 August | 98 | 23 | 1715 |

[1] The working out of the collection of butterflies is not yet completed, but it seems probable that it comprises from 150 to 170 different species, of which perhaps a dozen or so may prove to be new.

# AMUNDSEN'S ANTARCTIC EXPLORATIONS.

By R. N. Rudmose Brown, D.Sc.

Captain Roald Amundsen's unexpected announcement in October 1910 that his Arctic expedition was to be preceded by an attempt for the South Pole, caused considerable surprise, but carried with it an assurance that the Pole would in all probability be reached, and that in any case important geographical discoveries would be made. Amundsen had already made a great name for himself in his accomplishment of the North-West passage in the *Gjöa*, and had proved his determination, his grit, and his powers of endurance. It was characteristic of the man to make light of a dart at the South Pole, and to consider it a mere preface to his long drift across the North Polar basin; and no less typical of this Norseman was his silence concerning his plans. Publicity never seems to have made any great appeal to him, and the dramatic touch which he has introduced into polar exploration was merely incidental to his plans and to the nature of the man, and was not sought for as a studied effect.

Amundsen's main object was to reach the Pole; other exploration was to be subsidiary to that aim. As long as the attainment of the Pole entailed a new track across Antarctica—as Amundsen's did—no one, not even the most exacting man of science, could legitimately quarrel with the ambition. If the Pole was the bait that lured man on into the unknown interior of Antarctica, the quest of the Pole was justifiable; and so it will be in the future, provided only that, now it has been reached, explorers do not follow in one another's footsteps, but that each chooses a new route. Moreover, the elimination of the competitive element will probably ensure on the part of future expeditions a greater devotion to scientific research; yet it must be admitted that in years to come, under the changed conditions of polar exploration, it will be even more difficult than in the past to interest the public with the very necessary object of raising the required funds.

The *Fram* sailed direct from Madeira to the Ross Barrier, where winter quarters were established in 78° 40′ S. at the Bay of Whales on the Barrier surface. It was a daring thing to winter on the floating end of the Barrier. The later discovery that open water occurred near the Ross Barrier during the whole winter must have accentuated the risk of large bergs calving off.

On 20th October 1911 the southern party started finally, five men with four sledges and fifty-two dogs, and provisions for four months. Depots were established at every degree, and fine progress was made over the smooth Barrier surface. In 85° S. the party reached the rough and crevassed edge of the Barrier against the plateau. Mountains of from 2000 feet to 10,000 and 15,000 feet fringe the plateau. These are, of course, a continuation of the ranges seen by Sir Ernest Shackleton to the east and south-east of the Beardmore Glacier. After twenty days' difficult climbing over large and much crevassed glaciers the main plateau

was reached in 87° 40′ S. The mountains are wider here than at the Beardmore Glacier, but there seem to be two ranges, of which one is the edge of Victoria Land, and the other branches off from Shackleton's Alexandra Ranges and runs *via* the Dominion Ranges to Amundsen's Queen Maud Ranges, which continue south-eastwards to an unknown distance. Between these two ranges Amundsen had several days' comparatively easy travelling, as far as surface was concerned, and actually downhill from 10,000 feet at the top of the Axel Heibergs Glacier to 8000 feet at the foot of the Devil's Glacier, separating the Dominion and Queen Maud Ranges. From the news so far to hand it is not yet clear whether he turned downhill to get an easier route through the mountains or whether the whole area had a southern slope. The main plateau was reached at 10,750 feet on 6th December. Thence they proceeded in fine weather and good sledging and ski-ing conditions till 14th December, when the Pole was reached. This was fully ten days earlier than it had been expected Amundsen would attain his goal, and even if Captain Scott has succeeded also—as we sincerely hope he has—there is little likelihood of his having forestalled Amundsen.

Four days were spent in the vicinity of the Pole in taking observations, and there is no doubt at all that Amundsen's claim is just that he "observed the position of the Pole as close as it is in human power to do with the instruments we had—sextant and artificial horizon." A theodolite would have given a finer degree of accuracy, but Amundsen took all possible precautions, and if he has not actually stood on the coveted mathematical spot he has not been a mile distant, and has quite likely even passed over it. It is fitting that a descendant of the Vikings should have been the first to reach this long-sought goal, and Amundsen has well merited the world-wide congratulations he has received.

The Pole was found to be at an altitude of 10,500 feet, which agrees with what has been predicted from Shackleton's discoveries when he attained 10,050 feet in 80° 23′ S.

On 17th December a start was made on the return journey. Following the same route, and picking up their depots without difficulty, Amundsen and his party reached their winter quarters on 25th January 1912, all well, with two sledges and eleven dogs.

Amundsen travelled at a speed never before equalled in South Polar exploration. The distance between his winter quarters and the Pole he gives as 870 statute miles. The southward march was thus done at the average speed of sixteen miles a day, and thus included the climb from the Barrier to the plateau, the most phenomenal feat of which was the ascent of the Axel Heibergs Glacier, to 10,600 feet, in four days. But, allowing for the four days' delay due to bad weather, and the time spent in the whole twenty days' climb, it will be seen that the journeys over the plateau and the Barrier were very rapid. The return speed was even more remarkable, and works out at an average of twenty-two miles a day. No doubt Amundsen was favoured in the weather he experienced, but the real explanation is to be found in the use of ski by

men who had been accustomed to them from childhood, and the employment of Eskimo dogs for traction. Under these circumstances it is little to be wondered that Amundsen made light of his journey, and always had a sufficiency of food, so that when he and his party returned to the *Fram* so far were they from starving that they could not eat as much as when they set out.

Amundsen not only chose an entirely new and unknown route to the Pole, but, dispensing with all such means of traction as ponies and motor sledges, had recourse to the long-tried and least problematical methods of polar travelling, dog sledges and ski: with these he has set an example of speed which it will severely tax any future explorer to rival. He took the dogs out with him in the *Fram*, and the care and precaution with which they were treated throughout is illustrated in more than one passage in his dispatches.

The most important discovery made by Amunsden—more so than the Pole itself—is the south-eastern termination of the Ross Barrier in about 86° S., 163° W.,[1] and the linking of Edward and Victoria Lands, for though the mountains on the east of the Ross Sea were not seen the whole way, there is no doubt from those that were discovered that this is the case. This discovery confirms the idea that the Ross Sea is a great bight in the plateau, probably of a rift-valley nature, whose southern and narrower end has been filled with ice forced into it from the plateau by such great glaciers as the Beardmore and Axel Heibergs Glaciers. This glacier ice is depressed below sea-level towards the Barrier face by its superincumbent load of snow, and thus it is that the bergs of the Ross Sea have been said to be snow-bergs rather than ice-bergs.[2]

Lieutenant Prestrud and two others were sent to explore Edward Land during Amundsen's absence in the south. Of their discoveries we have as yet been told nothing, but their explorations must have been of importance as being the first ever conducted in that land. Any geological discoveries made in Edward Land will throw light on the structure of Antarctica, and it is quite possible that Prestrud's party has managed to link up Edward Land with the mountains Amundsen sighted on the east of the Ross Sea. Of course these discoveries of prominent physical features form only half a solution of the problem, although they fill up the map; a knowledge of their structural features is equally important, and we hope that Amundsen obtained light on this during his journey through the ranges. His telegram mentions geological collections from both Edward Land and South Victoria Land.

There has been little doubt, in recent years, of the continentality of Antarctic lands, but Professor Penck and others had a theory that a

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[1] There is possibly a clerical error regarding the latitude in Amundsen's cablegram to the *Daily Chronicle*, since he writes of making this discovery when he was between 83° and 84° south.

[2] See "Some results of the British Antarctic expedition 1907-1909," R. N. Rudmose Brown, *Internationale Revue der gesamten Hydrobiologie und Hydrographie*, 1911, Leipzig, pp. 366-372, and this *Magazine*, May 1909, pp. 250-259.

frozen strait crossed Antarctica from the Weddell to the Ross Sea. The Barrier was held to be the Pacific end of this strait, while the Atlantic end was supposed to be west of Coats Lands (see this *Magazine*, xxvi. p. 263). In several recent papers (*loc. cit.*) the present writer has referred to this idea and pointed out the lack of evidence in favour of such a strait: in fact, how all the evidence pointed to one and not two land masses around the South Pole. Amundsen's discoveries have finally demolished this theory; there is no strait cutting Antarctica into two parts, and the present German Antarctic expedition working in the belief of such a lowland route across Antarctica, will be sadly disappointed. Instead of such a strait they will probably encounter high mountains in the interior of Coats Land.

The only knowledge that we have so far about the height of the land on the eastern side of the Ross Sea is that Edward Land, from the discoveries of Scott and Shackleton, is about 1000 feet. But Amundsen's new mountains further south must be higher to judge from the distance at which he sighted them. However, there seems to be a probability that the plateau to the east of the Ross Sea is lower than to the west, and this in all likelihood applies to the whole of that part of Antarctica which is bounded by the Pacific. But what becomes of the Queen Maud Ranges which Amundsen found stretching south-eastward into the unknown? To link them up with the Antarctic Andes of Graham Land, as has been suggested, is not a satisfactory solution of the problem, because of radical differences in structure. Possibly they cross to Coats Land or sink into the level of the plateau, while with equal likelihood the fold mountains of Graham Land are lost by faulting somewhere to the southwest of Charcot Land, where the Andean zone of disturbance met with resistance from the hard rocks of Antarctica.

In one point of nomenclature we cannot agree with Amundsen. Sir Ernest Shackleton named the plateau on which the Pole lies after King Edward. That Shackleton did not actually reach the Pole does not alter the fact that his name applies to the whole plateau region, and certainly to any part of it so near as the Pole was to his "furthest south." Other parts of this plateau at great distances might reasonably and usefully receive other names, but King Haakon Plateau cannot stand in the face of the previous name King Edward Plateau. There can be no discourtesy in pointing out this: it is simply a question of topographical nomenclature. Of other discoveries Amundsen tells us little. There were important meteorological observations at winter quarters, but the absence of the entire party of eight during the summer interrupted them at that season. However, these observations in relation to Captain Scott's, 250 miles to the west, should prove most important.

The slightness of the snowfall and the low temperatures, although open water was never far off, are noteworthy. The weather seems also to have been remarkably quiet at winter quarters. August was the coldest month, but September was so cold that the start of the southern journey had to be abandoned after reaching 80° S., for the sake of the dogs.

On the plateau also the snowfall appeared small. And in this no doubt lies an explanation of the remarkable surface of what was called the Devil's Dancing Room, where great ice crystals, formed, as Nansen suggests, in severe frost and wind, are kept polished by small quantities of hard driven and very fine snow. On the plateau fine weather and light winds were experienced in contrast to the strong southerly winds that Shackleton encountered.

We hope that there are some biological results, though we cannot expect many in marine zoology. A new bird is reported from Edward Land, but no details are given, and Amundsen notes two skuas in 84° 30′ S., *i.e.* some 400 miles from the sea.

It must be remembered that this expedition did not carry a large scientific staff, in fact only eight men all told were landed, and their object was first and last to reach the Pole. The exploration of Edward Land was only an afterthought, because the *Terra Nova* had been unable to land a party there. So we need not look for much detailed scientific work such as Scott's expedition with its large staff will accomplish. But what Captain Amundsen's expedition lacks in this respect is compensated for in his geographical discoveries. Nor must we forget the valuable oceanographical work accomplished by the *Fram* in the south Atlantic during the winter; the only pity is that it was not in higher southern latitudes.

It would be idle to speculate on the probable result of Captain Scott's expedition, since before these pages are in print definite news will possibly have arrived. The Japanese expedition entered the Bay of Whales and landed on the Barrier on January 16th this year, and has since returned to New Zealand.

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## PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

### Presentation of the Society's Gold Medal.

This Medal was presented to Mr. J. Y. Buchanan at the meeting of the Society held in Edinburgh on February 22nd. Before the presentation, Dr. Horne, Chairman of Council, said :—"The Council of the Royal Scottish Geographical Society have awarded to Mr. J. Y. Buchanan, F.R.S., the Society's Gold Medal, in recognition of his contributions to oceanography. Mr. Buchanan was chief assistant in the Chemical Laboratory of Edinburgh University, under Professor Crum Brown, when he received the appointment of chemist and physicist to the *Challenger* expedition, under Sir Wyville Thomson. The expedition lasted three and a half years, and visited all the oceans. As the ground was quite new, Mr. Buchanan, like the other members of the expedition, was able to do a large amount of work. His investigations on the specific gravity of samples of sea water opened up a variety of new

problems. Much of his later work had a bearing on this investigation, and also on the salinity and temperature of the ocean, and on the temperature of water under ice in the Antarctic regions and in frozen lakes. He also discussed the question of deep-sea thermometers, and undertook a valuable experimental measurement of the compressibility of glass and metals in connection with the effect of pressure on thermometers in deep water.

"Since 1893 he has conducted a series of investigations on the glacier-ice of Switzerland [some of the results of which are contained in the paper published in the present issue of the *Magazine*]. Mr. Buchanan has also accompanied the Prince of Monaco on many of his oceanographical cruises in the *Princesse Alice*, and has assisted in the fitting-up of the Oceanographical Museum at Monaco.

"In recognition of his scientific record, and especially of his oceanographical researches, it is fitting that he should now receive the Society's Gold Medal."

## Election of Members.

At a Meeting of Council held on Tuesday, March 12th, Mr. Stair A. Gillon, Edinburgh, was elected an Ordinary Member of the Society. Miss E. M. Coulthard, New Brighton, was elected an Associate Member.

Dr. Francisco P. Moreno, founder and director of the La Plata Museum, was elected a Corresponding Member of the Society.

## Teaching of Geography in Secondary Schools.

The Secretary reported that the meeting of teachers held on March the 2nd, 1912, had unanimously passed a resolution on this subject (see p. 213). Professor Lodge then pointed out that the Scotch Education Department in the regulation referred to in the resolution had taken a step extremely adverse to the interests of geography as well as of history in schools, reversing a policy which it had adopted about six years ago, and which was proving every year more beneficial to those subjects; that from that time separate papers in geography and history were given in the Higher Leaving Certificate Examination in English, but that under this regulation that practice was to be abandoned. Having heard this statement the Council unanimously adopted the following resolution: "That the Council of the Royal Scottish Geographical Society should co-operate with the Historical Association of Scotland in presenting a remonstrance to the Scotch Education Department against the recent changes in the position of history and geography in the Leaving Certificate Examination, and in asking for an interview with the Department."

## Geographical Association for Scotland.

The Secretary having mentioned that at the meeting of teachers on March 2nd a small committee had been appointed to consider the

advisability of forming a Geographical Association for Scotland and, if thought fit, to take steps towards its formation, asked whether, in the event of the formation of such an Association the Council would grant the use of its rooms for the holding of the meetings of the Association. Leave was unanimously given.

### Lectures in April.

Professor D. T. MacDougal will deliver the closing lecture for this Session on the following dates :—Dundee, 1st, Aberdeen, 2nd, Edinburgh, 3rd, and Glasgow, 4th April. The subject of his lecture will be "American Deserts."

### Memorial to Mungo Park and Richard Lander.

The Earl of Stair, President of the Royal Scottish Geographical Society, has been informed by the Town Clerk of the city of Glasgow that the corporation of that town has granted a donation of £25 towards the fund which is being raised to erect a monument on the Forcados arm of the delta of the river Niger to the memory of Mungo Park and Richard Lander (see vol. xxvii. p. 658).

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## GEOGRAPHICAL NOTES.

### Europe.

**The Vegetation of Caithness.**—There has been recently published, under the auspices of the Committee for the Survey and Study of British Vegetation, a memoir by Mr. C. B. Crampton of H.M. Geological Survey, entitled *The Vegetation of Caithness considered in Relation to the Geology*, a paper which, as Dr. W. G. Smith remarks in his preface, breaks new ground as regards descriptive ecology. The special peculiarity of the treatment is that the author approaches the subject from the geological standpoint, and regards the existing plant formations as but links in an endless chain, the particular formation existing at the present time being determined by physiographical conditions. Further, the author distinguishes between comparatively stable associations, such as the typical moorland ones, and those which "are practically confined to habitats consequent on surface changes lately induced by combinations in the geological activity of gravity, wind, and water."

He goes on to point out, in an extremely interesting fashion, that the stable formations occur on ground which owes its main features to past geological processes, while the newer or migratory formations, which limit and dissect the stable ones, are found on ground which owes its character to recent processes. We cannot here give any detailed account of Mr. Crampton's results, but his paper is of great geographical interest. Peat, with its characteristic moorland plants, seems once to have covered practically the whole of Caithness, as it covered so much of Scotland elsewhere also, its presence being a result of the conditions

which prevailed at the close of the glacial period. The moorland plants require peat as a necessary condition of their existence, but Mr. Crampton speaks of the peat as "inherited," meaning that it was the product of conditions which have largely ceased to exist. Thus if the existing peat be destroyed, it does not re-form, and its characteristic plants soon disappear. Now peat forms a soil almost useless for man's purposes, and his task of reclaiming the land rendered sterile in this way by the effect of the glacial period would have been much more difficult than it has been, if the ordinary agents of erosion in stream-valley, sea-coast, and elsewhere had not, since the passing away of the ice, been engaged in destroying the peat and thus in helping the migratory plant-associations to displace the moorland plants, and so prepare the way for his crops. Thus Mr. Crampton's results from one point of view afford a very interesting commentary on Professor Vidal de la Blache's statements, quoted here (vol. xxvii. p. 486), that the changes which have resulted from the passing away of the glacial period have been one of the factors which led ultimately to the prosperity of the northern countries of Europe and America. These changes introduced, among other effects, a marked instability in the natural plant formations, of which man has not failed to take advantage for his own purposes.

## Polar.

**An American Polar Expedition.**—A new Polar expedition is being arranged under the auspices of the American Museum of Natural History and the American Geographical Society, with the co-operation of Yale University and other institutions. The objects of the expedition are "to reach and map out Crocker Land in the North Polar seas northwest of Grant Land, and to make all the scientific studies *en route*, and in other parts of the Arctic regions, that circumstances may permit."

The expedition is to be headed by Mr. George Borup, assistant curator of geology in the American Museum of Natural History, and Mr. Donald B. MacMillan, who were both members of Admiral Peary's last Polar expedition. It will leave Sydney, Cape Breton Island, by special steamer in July, collecting dogs and whale and walrus meat on the way northward. Winter quarters will be established on the south side of Bache Peninsula, which projects from Ellesmere Island into Kane Basin, the ship being sent home. From September onwards during the winter supplies will be taken by sledge to Cape Thomas Hubbard (the northernmost point of Axel Heiberg Island). With the return of dawn in February 1913, the party will leave Cape Thomas Hubbard, and push across the ice to Crocker Land (Crocker Land is supposed to have been seen by Peary in 1906), where they will remain until May. After sending a messenger to North Star Bay with news of the expedition, the party will carry on scientific work in Grant Land and along the return route to winter quarters on Flagler Bay, arriving there in July 1913. During the summer supplies and collections will be transferred to Etah, and in the spring and summer of 1914 an expedition will be made from

Whale Sound directly eastward to the summit of the ice-cap of Greenland, at the widest part of that island. The party will finally return to New York by special ship in the autumn of 1914.

### General.

**Livingstone Centenary.**—As the centenary of the birth of David Livingstone takes place next year, it is proposed to hold, in the Royal Scottish Museum, Edinburgh, an exhibition of relics and other objects associated with the great explorer. Dr. A. Galt, Curator of the Technological department at the museum, who is making the arrangements for the exhibition, will be glad to have the loan of objects which would form suitable exhibits, and invites correspondence from members of the Royal Scottish Geographical Society and others who may be able to assist in the obtaining of such objects.

**The British Association.**—At the meeting of the British Association for the Advancement of Science, which is to take place this year at Dundee on September 4, and the following days, under the presidency of Professor E. A. Schäfer, LL.D., D.Sc., M.D., F.R.S., the following will be the presidents of the Geographical and related sections:—*Geology.*—B. N. Peach, LL.D., F.R.S. *Geography.*—Sir Charles M. Watson, K.C.M.G., C.B., R.E. *Economic Science and Statistics.*—Sir Henry H. Cunynghame, K.C.B. *Anthropology.*—Professor G. Elliot Smith, M.D., F.R.S. Agriculture will form the subject of a full section for the first time.

Professor W. H. Bragg, F.R.S., and Professor A. Keith, M.D., will deliver the evening discourses.

**The International Congress of Anthropology and Archæology.**—We are informed that this Congress will hold its fourteenth meeting at Geneva in the first week of September in the present year, under the presidentship of M. G. Pittard. The Congress admits members and associate members, the subscriptions being 25 fr. and 15 fr. respectively, and communications should be addressed to the general secretary, M. W. Deonna, 16, Boulevard des Tranchées, Geneva. In addition to the indoor meetings scientific excursions will be made to interesting prehistoric sites in Switzerland, and it is hoped to carry out excavations on behalf of the Congress in a Neolithic station on the lake of Neuchâtel. A day on the lake of Geneva in a specially chartered steamboat will also be arranged for the members at the expense of the Congress.

## EDUCATIONAL.

Meeting of Teachers in Society's Rooms.—The meeting to which reference was made in our last issue (p. 146) took place as arranged on Saturday morning, March 2. Mr. Chisholm took the chair, and read to the meeting the note in Circular 365, issued by the Scotch Education

Department in October last, which was to form the subject of discussion. This note is in the following terms :—

"In the Lower Grade, papers in History and Geography, for each of which one hour and a half will be allowed, will continue to form an integral part of the written examination in English, and must be taken by all candidates presented in Lower English.

"In the Higher Grade, on the other hand, the written papers in History and Geography will no longer form an integral part of the examination in English ; although the curriculum of any candidate who is presented in Higher English must include some further study of History (see Circular 340, page 3, paragraph 6), it is not proposed to test such subsidiary study by means of a special written paper in History. The written examinations in History and Geography should accordingly be taken only by candidates who have given these subjects very particular attention, and have devoted an adequate amount of time to them during their Post-Intermediate course. In view of the position which Higher Grade History and Geography will henceforward occupy in connection with the Full Leaving Certificate, the standard of attainment exacted must necessarily be commensurate with the standard required in other independent subjects, *e.g.* Languages and Mathematics."

Mr. Chisholm then went on to say that it should be recognised that the aim of the Department was probably to put Geography and History on a higher level than formerly, but various teachers had pointed out to him that, practically, this regulation would turn out in several ways prejudicial to the position of Geography as a school subject, and in the long run to Geography as a University subject, and the meeting had been called to give teachers an opportunity of stating how they believed it would affect the teaching of Geography.

Mr. Muir, of the Royal High School, proposed that Geography should be made a compulsory subject throughout the whole school curriculum, and that it should be separated from English in the Intermediate as well as in the Post-Intermediate stage. Mr. Lee, of George Heriot's School, supported Mr. Muir on the ground that the new regulation would probably result in the crowding out of Advanced Geography from the curriculum, for it would be very difficult for headmasters to find the time necessary for the elaborate study of the subject suggested in the note.

Mr. Smith, of Merchiston Castle, opposed the suggestion that Geography should be made compulsory throughout the whole school course, on the ground that while Geography was an illuminating subject up to a certain stage, say to 14-15 years, he was not sure that between this age and the University stage the subject was one suited to all types of scholars. Mr. Cossar, of Glasgow Training College, pointed out that if University students generally could not be assumed to have reached more than the Intermediate Stage of geographical training, then it made the subject rather hopeless from the University standpoint.

After some further discussion Mr. Cossar proposed the following resolution :—"That this meeting of teachers of Geography, while gratefully recognising the aim of the Scotch Education Department in the

regulation of page 5. Circular 365, as to the future position of Geography in the Post-Intermediate curriculum, nevertheless views with apprehension the probable effect of that regulation, and recommends that, if pupils are to be allowed to drop this subject entirely in the Post-Intermediate stage, opportunity for the more adequate teaching and study of the subject should be given in the Intermediate course." This was seconded by Mr. Smith and carried unanimously, and it was resolved to transmit it at once to the Scotch Education Department, as well as to the Council of the Scottish Geographical Society.

It was then proposed that a committee be appointed to discuss the advisability of promoting a Geographical Association for Scotland, the following gentlemen to be part of that Committee:—Mr. Muir, Royal High School: Mr. Lee, George Heriot's School: Mr. Hume, Glasgow High School: Mr. Cossar, Glasgow Training College; Mr. Chisholm, Edinburgh University. These gentlemen having notified their willingness to stand, the meeting was brought to a close after a vote of thanks to the chairman.

## NEW BOOKS.

### EUROPE.

*How to see Italy by Rail.* By Douglas Sladen. With 160 Illustrations from Photographs by the Official Photographer, and Dorothy Ridley. London: Kegan Paul, Trench, Trübner and Co., 1912. *Price* 7*s.* 6*d. net.*

Not only by rail may you see Italy under Mr. Douglas Sladen's entertaining guidance, but by motor, and by cycle, and on foot as well. He devotes a useful chapter to the Touring Club Italiano, an organisation which has helped greatly to make Italy popular with the tourist, both native and foreign. He heads his chapters "How to see Lombardy, Venice, Genoa, etc.," which at once arrests and delights the sightseer. One charming district he has entirely left out, that stretching to the west of Turin, to Pignerolo, Torre Pellice, etc., and to the foot of the Cottian Alps. It is a region lovely in itself, and full of historic interest, and often passed by travellers, because guide-books nearly all tread the same well-trodden routes. One would have thought Mr. Douglas Sladen, who opens up a new way of seeing the country, would not have omitted this interesting and beautiful region. He may astonish some by saying, "Italy is an ideal place for a summer holiday. It is hot. But you want lovely weather for a holiday, and as the Italians know that their summers will be hot, there is plenty of shade." If the northern part of the country is kept to, his advice is excellent, but south of Florence the heat would be rather trying for the dwellers in the British Isles. The book is well illustrated by a fine series of photographs. A map of Italy, with the routes indicated, would have improved its value. As it is there is no traveller to Italy who will not find it most helpful.

*The Story of Avignon.* By Thomas Okey. Illustrated by Percy Wadham. London: J. M. Dent and Sons, Ltd. New York: E. P. Dutton and Co., 1911. *Price* 4*s.* 6*d. net.*

This is another of the Mediaeval Towns Series, and it quite sustains the high standard of these publications. Avignon, in the early and middle ages, suffered the fate of its position. Occupying a commanding situation on the great water-

way of the Rhone, the centre of one of the richest districts of France, having a fine climate, it has been from time immemorial coveted by succeeding hordes of lawless races, and has been the continuous scene of fierce and pitiless warfare. It is perhaps best known to us as the temporary home of the Papacy, but apart from that, many great names rise before the reader from the Raymonds of Toulouse onwards, not forgetting the Arab struggle in the time of Charles Martel. The compilation of such a piece of disconnected history has been no easy task, but it has been ably performed.

*Old Ross-Shire and Scotland, as seen in Tain and Balnagown Documents.* By W. MacGill, B.A., London. Supplementary Volume. Inverness: The Northern Counties Newspaper and Printing and Publishing Co., 1911. *Price* 7*s.* 6*d.*

The original volume of this work was noticed in this *Magazine* in vol. xxvi. p. 105. Additional documents having come into the author's hands he gives in this supplementary volume a calendar prepared on the same lines as that in the original volume, continuing the numeration and giving references to documents in it with which the new documents are associated. The most important document now dealt with is a minute-book of the Baron Courts of Balnagown. The period dealt with is 1620 to 1735, while the Records of the Baron Court of Stitchell (Scottish History Society, No. 50) only begin in 1655. It is interesting to notice that the principle of the First Offenders Act was accepted and acted upon in the middle of the seventeenth century, and that sheep-stealing and other offences more harshly dealt with in the south were punished by fine and whipping. The Burgh Records of Tain also furnish interesting information. In 1665 two members of the Town Council were found guilty of "Ryot and unseasonable language," each fined £12, and suspended "during the Counsell's good pleasure." The right to the mussel scalps seems to have given rise to great litigation and strife. This additional volume adds much valuable material to that formerly provided for the genealogist and the student of the history of Tain and neighbourhood. In a concluding note a good case is made out for Tain's claim to be the oldest burgh in Scotland.

*Austria-Hungary, with Excursions to Cetinje, Belgrade, and Budapest. Handbook for travellers.* By Karl Baedeker. Leipzig: Karl Baedeker. London: T. Fisher Unwin, 1911. *Price* 10*s. net.*

This is the eleventh English edition and corresponds to the twenty-eighth German edition. As compared with previous issues it shows several new maps and plans, some in the text and some on special paper. These should greatly increase the usefulness of the book.

*Memoirs of the Geological Survey, Scotland. The Geology of the Glasgow District* (Glasgow District Map, including parts of sheets 30, 31, 22 and 33). By many authors. *Price* 4*s.* 6*d.*

*The Geology of Colonsay and Oronsay with part of the Ross of Mull* (Explanation of sheet 35, with part of 27). By E. H. Cunningham Craig, B.A., W. B. Wright, B.A., and E. B. Bailey, B.A. *Price* 2*s.* 3*d.* Edinburgh: Printed for H. M. Stationery Office, 1911.

Of these two memoirs that relating to the Glasgow district has already been noticed here (p. 98); the other contains a considerable amount of geographical matter. Among the interesting points discussed in it are the raised

beaches of Colonsay and Oronsay: in the former island extensive Neolithic remains occur in connection with the 25-foot beach, caves being numerous along the old shore-line. Colonsay is remarkably fertile despite its rocky and forbidding aspect from the sea, the fertility of the hill pastures being apparently due to the distribution by the wind of the shell-sand which is being continually thrown up on the western shores of the islands.

## ASIA.

*Kerala: The Land of Palms.* By I. H. Hacker. With Chapter by Basil Mathews, M.A. 4 Coloured Plates and 63 Illustrations. London Missionary Society, 1912. *Price* 2*s.*

Kerala is one of the native names of Travancore, and we have in this little book a picturesque account of the land and the people, of how Christianity came to the country, and of the work going on now. The story is addressed to young readers and is sure to interest them.

*Palestine.* By G. E. Franklin, F.R.G.S. London: J. M. Dent and Sons, Ltd., 1911. *Price* 10*s.* 6*d. net.*

Mr. Franklin, like many other people, notices and is disposed to regret the many changes which are rapidly transforming and modernising the appearance of the places and the manners of the people in the Holy Land. Railways, tramcars, electric light, and modern appliances generally are having their usual results. "Well-to-do ladies are beginning to adopt Parisian fashions, and may be seen wearing dresses that may have been purchased in the *magasin* of the Louvre or in Oxford Street, in place of the beautiful indoor native attire like that which their grandmothers and their grandmothers' grandmothers wore from the earliest ages. The worst of all this is that innumerable old customs which illustrate Bible scenes and incidents, and which explain and throw light on so many passages of Scripture not properly understood, are fast dying out, and I have longed for some reliable and enduring record of them to be preserved. I have, therefore, tried to secure some photographs of the life of the people and customs of the land, taken in most cases without their knowledge, as well as recent views of the scenery of the country." Certainly Mr. Franklin has succeeded in his modest endeavour, and has produced a beautifully illustrated volume, thoroughly conventional in doctrine and reverent in its tone, and well calculated to be of considerable use to those for whom it is written, viz., "the general reader, the tourist," and "those Sunday-school teachers, Bible-class leaders, and even ministers who, being busy workers, have but little time and opportunity to make a digest from the various works already published." With this volume in hand they may dispense with a Baedeker as long as they keep to the beaten tracks. There is a profusion of excellent and up-to-date photographs which illustrate buildings, places, scenes, and incidents of daily life in the Holy Land, and which alone would make this book acceptable to many.

*Things Seen in Northern India.* By T. L. Pennell. With 50 Illustrations. London: Seeley, Service and Co., 1912. *Price* 2*s. net.*

This little book, another member of the "Things Seen" series, gives an interesting if not very profound account of India, and is profusely illustrated. It should be useful alike to travellers to India and to those who wish to obtain some knowledge of the life of the people and the character of the country.

*Durch Armenien: Eine Wanderung, und Der Zug Xenophons bis zum Schwarzen Meere: Eine Militär-Geographische Studie.* Von E. v. Hoffmeister. Leipzig und Berlin: B. G. Teubner, 1911. *Preis* 8 *m.*

This is a conscientious if slightly dull account of a journey from Poti to Tiflis, Kars, Erzerum, Trebizond and Kerason. The author is of those travellers who spare their readers no detail, and are apparently convinced that all that happens is interesting. Thus the number of "Wanzen" in the various inns is indicated in detail, and such incidents as that the author's cap blew off on one occasion, and that on others the kettle would not boil in time for breakfast, are allotted a full share of space. But the patient reader will find also a good deal of useful matter: Herr Hoffmeister was specially interested in military affairs, and gives a large amount of detailed topographic descriptions, in connection with the various battle grounds of the region. He was also much interested in the ruins of Armenia, and gives some admirable photographs of the more striking of these. There are two useful maps, and the book is as well got-up as was its predecessor (see vol. xxvi. p. 213).

## AFRICA.

*'Twixt Sand and Sea.* By Cyril Fletcher Grant and L. Grant (L.S.) London: Sampson Low, Marston and Co. Ltd., 1911. *Price* 21*s. net.*

This substantial and well-illustrated work will appeal to a wide circle of readers. The subject matter is the north coast of Africa betwixt the sand of the desert and the Mediterranean Sea. Students of history, ancient and modern, will find much to interest them in the first part, in which they have a series of well told episodes in the confused and complicated, but romantic and stirring history of the tract. Naturally Carthage, that marvellous "government of capitalists," affords to the writers an irresistible opportunity of retelling and they have done it well the thrice-told tale of the Punic wars, with which such ever famous names as Regulus, Fabius, Scipio, Hasdrubal and Hannibal are inseparably associated. But in addition to the story of the wars an excellent account is given, briefly but comprehensively, of the constitution, religion, and manners of the famous Libyan masters of the Mediterranean, their glory, their decadence and their fall. Even the unemotional Mommsen seems to have been stirred to pity by the terrible fate of Carthage, when he says, "The ruins burned for seventeen days. Where the industrious Phœnicians had bustled and trafficked for five hundred years, Roman slaves henceforth pastured the herds of their distant masters. Scipio, however, whom nature had destined for a nobler part than that of an executioner, gazed with horror on his own work; and instead of the joy of victory, the victor himself was haunted by a presentiment of the retribution that would inevitably follow such a misdeed." The scene of action shifts, as time goes on, to Utica, Timgad, Cirta, Alexandria, Kairwan, Algiers and elsewhere, and other names, not all of them soldiers, flit across the pages, Jugurtha, Marius, Pompey, Tertullian, Pulcheria, Cyprian, Augustine, Belisarius, Barbarossa, each one of them fitted "to point a moral or adorn a tale," so that it can be easily understood, how, in the historical part of this book, the interest never flags. We must also remark that the authors have made a careful study of the remains of cities, temples, forts, etc., which abound all over the region they describe, and they are particularly successful in so portraying the sites and localities that the reader has no difficulty in following their descriptions, and in this he is materially assisted by the numerous photographic illustrations, several of which are of exceptional merit. We trust we have said enough to secure the perusal of this interesting work by the students of history

and archaeology; we may add that its perusal will considerably increase the enjoyment of the innumerable tourists who from year to year spread themselves over the north coast of Africa. The Italians also may cull from its pages much useful information about the history, past and present, of the turbulent Berber tribes which are likely to give them a good deal of trouble in the hinterland of Tripoli.

## AMERICA.

*Ranching, Sport, and Travel.* By Thomas Carson, F.R.G.S. London: T. Fisher Unwin, 1911. *Price* 10*s.* 6*d. net.*

Mr. Carson's book deals mainly with his experiences while cattle ranching in Arizona and New Mexico, and we venture to think that this will be found to be the most interesting and attractive part of it. The time dates back to about thirty years ago, before the great upland plains of Arizona territory had been fenced off and settled as they are now, and when the herds of cattle roamed over a wide extent of country, and the question of ownership of the runs was not defined as it is to-day. In the first instance, Mr. Carson was sent to take charge of cattle which were being grazed on the reservation of the Apache Indians, where they had no right to be, but the U. S. authorities made no serious attempt at the time in question to put a stop to this kind of poaching. The reservation, he says, was a hunter's paradise, abounding in game of many kinds, covered with forest trees broken here and there into open prairies and meadow lands which were drained by clear streams "hotching" with trout. The life of the rancher was no bed of roses. Often alone in a wild country, he tended his cattle, and hunted and fished for the pot, facing the hardships and dangers inseparable from such an existence. From Arizona, the author went on to New Mexico, in charge of the interest of a Scottish Land and Mortgage Company, for whom he seems to have done good service, and then he started his own ranch on which he became a well-known and very successful breeder of cattle. Written in a free-and-easy, off-hand fashion, with no special claim to literary style, Mr. Carson's book affords a vivid and truthful picture of the life it portrays, and we feel that we have a real account of very real experiences. Only by free quotation, for which there is no room here, could we do justice to it. The rest of the book is taken up with brief notes of five separate tours abroad which are not of special interest. Of the illustrations, the one of "broncho-busting" is particularly good and true to life.

*A Naturalist on Desert Islands.* By Percy A. Lowe, B.A., M.A. (Cantab.). London: Witherby and Co., 1911. *Price* 7*s.* 6*d. net.*

In this well-illustrated volume the naturalist, and, more especially, the ornithologist, will find much interest and instruction. It contains an account of visits paid within the last six years to certain islands in the Caribbean Sea and the Gulf of Mexico, some of them so little known that "the staff of the Royal Geographical Society had never heard of them!" The writer was a guest on the yacht of Sir Frederic Johnstone, and in the course of the cruises visited several practically desert islands "for the sake of what they are in themselves, and for the sake of what they contain of beast and bird, of rocks and land-flowers, of sea-flowers and coral-gardens." The party met with no exciting incidents or adventures, not even with sharks. They had some excellent fishing, and on one occasion they were interviewed by a Venezuelan gun-boat, the commander of which presumably supposed them to be the emissaries of some of the numerous enemies of

that somewhat unstable republic. But the main interest of the book is due to the finds in the way of rare plants and animals, which have been made over to the Natural History Museum at South Kensington. The greater part of the book is scientific, and as such is valuable and instructive, but the author out of slender materials has succeeded in producing a general narrative of the story of the cruises in little known waters and places which will be found of interest to others besides the naturalist.

*The Making of a Great Canadian Railway.* By FREDERICK A. TALBOT. London: Seeley, Service and Co., Ltd., 1912. *Price* 16*s. net.*

This is, as the title shows, the story of the search for and the discovery of the route, and the construction of the nearly completed Grand Trunk Pacific Railway. We have been told elsewhere the splendid history of the Canadian Pacific Railway and its success, and now Mr. Talbot stirs our imaginations by an account of the sudden expansion of the Grand Trunk Pacific Railway. This line, he tells us, had fallen into evil days, and was being strangled out of existence by competing lines. It was at this stage that Charles M. Hays, the "little American," who had made his name on the Southern Pacific Railway, was invited to take charge. He had seen on a previous visit the weak points of the Grand Trunk, that it was insulated, and he evolved in his brain the daring scheme of carrying his line to the Pacific Coast, thus making it independent, and tapping fresh fields of enterprise. Mr. Talbot has visited every mile of the track, fraternising with the men at work, travelling as best he could, often on foot, and he gives a most realistic picture, not only of the immense possibilities of the country traversed, but of the hardships being endured by the pioneers. The book is not written from a severely technical point of view, and will interest alike the intending settler and the sportsman.

*Under the Roof of the Jungle. A Book of Animal Life in the Guiana Wilds.* By CHARLES LIVINGSTONE BULL. With sixty full-page plates and many minor decorations from drawings from life by the author. London: Duckworth and Company, 1911. *Price* 6*s. net.*

It is a modern development of the study of natural history to investigate minutely the life-stories of animals and to present the result in the form of a romance. One is not always quite certain whether in some cases truth is not sacrificed in the interests of artistic completeness. In a series of fourteen sketches Mr. Bull gives impressions of representative animals in the wilds of Guiana. Some of the titles are rather fanciful, such as the "Black Witches of the Savannah," the "Murderers of the Brown Water," and the "Sexton of the Jungle." As might be expected, the dominant note is a tragic one, and an episode or two relating to the prime instead of the end of life would have relieved the gloom of the book. We have nothing but praise for the illustrations, especially those in colour, and we congratulate Messrs. Duckworth on the excellent appearance of the book as well as on its cheapness.

## AUSTRALASIA.

*New Zealand.* By the Hon. Sir ROBERT STOUT and J. LOGAN STOUT. Cambridge: At the University Press, 1911. *Price* 1*s. net.*

Though necessarily much condensed, this book may be recommended as giving a clear and fairly comprehensive account of New Zealand. The sections on

government, education, law, and recent legislation are especially full, while those on geography in the strict sense are short; but this is perhaps no disadvantage, for details as to physical structure, etc., are more easily obtained than those in regard to the subjects named. But it seems to us a pity that the subject of the population and its distribution should be so scantily treated. No exact figures of the present population appear to be given, and there are no details in regard to such points as the occupations of the people and the density of population in the various regions; yet all those points have obviously an important bearing on questions of law and government.

*My Tropic Isle.* By E. J. Banfield, author of *The Confessions of a Beachcomber.* London: T. Fisher Unwin, 1911. *Price* 10*s.* 6*d. net.*

Mr. Banfield does not favour his readers with information as to the precise latitude and longitude of the island of the blessed in which he has set his abode; but we gather that it lies somewhere off the coast of North Queensland, inside of the Great Barrier Reef, and we have his word for it that it is the most fascinating and desirable island on the coast. This latest book, which fills in some of the blanks left in the *Confessions of a Beachcomber*, tells us how, having acquired certain legal rights to the area, the author set to work to build his bungalow, largely with the labour of his own hand, also how he and his wife led the simple life, acquiring a store of health in the process. We also have a sketch of the domestic budget, which shows, amongst other items, that they spend a larger sum annually for postage stamps than for clothing and boots. That the island is beautiful we can judge from the illustrations, as well as from the text, and nature is bountiful to the hermits, in yielding them a generous supply of the fruits of the earth. But even this Eden has its drawbacks, in the shape of snakes and venomous insects, with which it appears to be plentifully stocked. Mr. Banfield has a very pleasant and attractive style of writing, and his chapter on "Silences" is one of great beauty. The book is partly made up of papers contributed by the author to a Queensland newspaper; many of these, being descriptive of the teeming life of the mud banks within the reef, are chiefly of interest to the biologist, but we also have some interesting glimpses of the lives of the black folk and of their customs, while the author's own philosophisings afford pleasant reading. Altogether *My Tropic Isle* is a book well worth perusal, and we feel as we lay it down that we should be glad of some more of its author's experiences.

## POLAR.

*In Northern Mists: Arctic Exploration in Early Times.* By Fridtjof Nansen, G.C.V.O., D.Sc., D.C.L., Ph.D., etc. Translated by Arthur S. Chater. Two volumes. London: William Heinemann, 1911. *Price* 30*s. net.*

The great majority of our readers will, we trust, need no introduction to, or recommendation of, these substantial and erudite volumes; but let not those who had the good fortune to hear Dr. Nansen's address to the Society at the beginning of this session suppose that they can pass the book by, as one of which they have already got the cream. The address, interesting as it undoubtedly was, dealt with merely one branch of the vast subject which Dr. Nansen has patiently and skilfully expiscated. Starting with the intention to write a history of arctic exploration he found that the subject demanded earnest and severe study of a vast literature and tradition, a study which soon convinced him that in the current notions and authorities there were endless inaccuracies and errors. With the courage and

enthusiasm of a veteran explorer, and the patience and almost meticulous carefulness of a student, he plunged into the *Northern Mists* with the intention of sifting and extracting as far as was possible the truth from conflicting authorities and claims, and from obscure legends and traditions. One result is that Dr. Nansen has never reached the length of Arctic voyages, as we now understand the expression, at all; and this is indeed by no means to be regretted, for we have already several satisfactory books on the subject. Instead of repeating for us a thrice-told tale Dr. Nansen has been induced to investigate and explore many strange highways and by-ways in the realms of ancient discovery and adventure, and has presented to us a work, accomplishing what has never been done before, which cannot fail to enhance his already high reputation in the literary world.

As might be expected, Dr. Nansen writes as a Norseman, and he claims for his countrymen that they discovered Greenland, Labrador, and Newfoundland. But before he comes to that part of his investigation, he has most interesting chapters on the early voyages of antiquity and the Middle Ages; and certainly it would be hard to find a name more appropriate than *Northern Mists* to the accounts we have of these voyages, with a very few exceptions, such as that of Pytheas of Massalia. A perusal of these chapters will impress the reader with a sense of the unwearied application and impartial judgment, which Dr. Nansen has brought to bear on many perplexing, confused, and conflicting problems. Nor is his task any easier when he comes to the exploits of his own countrymen. They are shrouded in the mists of tradition, folklore, and sagas, and the work of tracing out, comparing, and selecting what is true, or at least probable, has evolved in Dr. Nansen the best qualities of the historian. The same may be said of his later chapters on the voyages of the Cabots and the Portuguese. With regard to the exploits of the Norsemen they are summed up thus, "they penetrated the vast unknown solitudes in the North, found their way to the White Sea and its shores, colonised the Faroes, Iceland, and Greenland, and were the first discoverers of the Atlantic Ocean and of North America": and it is to be noted, that "as yet we have not passed the northern limits of our forefathers' voyages." Some idea of the labour bestowed on this book may be gathered from the fact that the list of only the more important works referred to requires thirteen pages to itself. The work is profusely illustrated with quaint old maps and drawings from ancient documents and manuscripts.

## GENERAL.

*Fourth Report of the Wellcome Tropical Research Laboratories at the Gordon Memorial College, Khartoum.* Vol. A.—Medical. *Price* 21*s. net.* Vol. B.—General Science. *Price* 18*s. net.* Supplement to Fourth Report, *Review of some of the more Recent Advances in Tropical Medicine, etc.* By A. Balfour and R. G. Archibald. *Price* 13*s. net.* London: Baillière, Tindall and Cox, 1911.

Dr. Andrew Balfour and his assistants are steadily issuing from the laboratory of the Gordon Memorial College a series of elaborate reports which have a much wider interest than the medical one, great though this is. The geographer, familiar with the conditions of city life in civilised communities, has often difficulty in realising in detail those of non-civilised ones, and thus in distinguishing between influences which are purely climatic and those dependent upon an imperfect adaptation of human communities to a given environment. In these volumes he will find full details not only of the existing conditions in the Sudan, but also

of the changes which are being steadily brought about. Two articles by the Director, one on "Some Aspects of Tropical Sanitation," and the other called "Sanitary Notes," seem to us of especial interest in connection with the important problem of the extent to which tropical Africa can be made habitable for civilised races; but there are many other articles of great geographical importance in the volumes.

*Early Spanish Voyages to the Strait of Magellan.* Translated and edited by Sir Clements Markham, K.C.B., Vice-President of the Hakluyt Society. London: Printed for the Hakluyt Society, 1911.

In this, the latest, publication of the Hakluyt Society we have a number of narratives of expeditions despatched by the Spanish Government to Magellan's Strait and the Spice Islands in the sixteenth century, when Portugal and Spain were fighting for the dominion of the East in general and the Spice Islands in particular. The work of translation and editing was confided to the veteran Sir Clements Markham, who some sixteen years ago had translated and edited the *Voyages of Pedro de Sarmiento.* Now, as then, the work has been done with consummate skill and a thorough mastery of the subject in its historical and technical aspects. Departing from the usual practice in these publications, Sir Clements has added a separate introduction for each of the narratives, and in them and the notes we have abundant proof of the patience and care, the scholarship and the erudition, which he has brought to bear on the work. The narratives themselves are of intense interest to the historian and geographer. They portray to us at first hand from eye-witnesses and those who played, some prominent, and some subordinate parts in the prolonged and often ferocious struggle for supremacy, episodes of adventure and daring as well as hardship and misfortune, which would seem more appropriate to the pages of romance or even imagination, rather than to those of sober history. Of the seven ships which were despatched under Loaysa in 1525 only one returned, and the greater number of the members of the expedition died during its progress. Among such were the commander Loaysa, and the still more distinguished second-in-command, Sebastian del Cano, who had taken a prominent part in Magellan's ill-fated expedition in 1519 and was the first man to circumnavigate the globe. The story of the extraordinary vicissitudes of fortune which befell the expedition is narrated in simple language by Captain Andreas del Urdaneta, one of the survivors, in a report to the King of Spain in which he shows some of the most valuable qualities of a writer and a seaman—brevity combined with lucidity of expression, quick observation, thorough command of details, a judicious sense of proportion, and a skilful appreciation of the resources of the country (the Spice Islands) which he visited. One of the most interesting parts of the book is the instructions given to Loaysa, the commander, which throw much light on the policy of the King of Spain, the discipline and routine on board his ships, and the attitude enjoined on the members of such expeditions to natives of foreign countries.

The interest of the story of the expedition of the two gallant brothers Nodal in 1618 to Magellan's Strait is purely geographical. From the extremely interesting introduction by Sir Clements Markham we learn that both brothers had distinguished themselves in several naval battles against the English, Dutch, Turks and pirates, and had most deservedly secured the confidence of the King of Spain. Their high reputation as sailors fully warranted their selection to command a distant expedition, and they started off in two vessels of eighty tons each, manned by crews who had been pressed by force and did not know their destination, as

apparently it was apprehended that if they did know it they would abscond. The preface to the reader by the brothers at the beginning of this report is singularly modest. Sir Clements sums up the results of the expedition thus: "The voyage of the Nodals was completely successful, they reached the new strait (Le Maire), examined its shores and anchorages, took many soundings, and carefully observed the phenomena of tides and currents. They also collected implements of the natives, skins of animals, and some botanical specimens. Their superiority to the Dutchmen as observers is very striking. . . . They were the first to circumnavigate Tierra del Fuego."

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*The Gambia, its History, Ancient, Mediæval, and Modern; together with its Geographical, Geological, and Ethnographical Conditions, and a Description of the Birds, Beasts, and Fishes found therein.* By Henry Fenwick Reeve, C.M.G., M.I.C.E., F.R.G.S., F.A.S., etc. With Illustrations and Maps. Demy 8vo. Pp. xvi+288. *Price* 10*s.* 6*d. net.* London: Smith, Elder and Co., 1912.

*The Oxford Geographies. The Clarendon Geography.* Vol. i. By F. D. Herbertson, B.A. Lond. With coloured maps, 133 Illustrations, and numerous exercises. Crown 8vo. Pp. viii+379. *Price* 3*s.* Oxford: Clarendon Press, 1912.

*Captain Cartwright and his Labrador Journal.* Edited by Charles Wendell Townsend, M.D. With an Introduction by Dr. Wilfred T. Grenfell. Illustrations from Old Engravings, Photographs, and a Map. Demy 8vo. Pp. xxxiv+385. *Price* 5*s. net.* London: Williams and Norgate, 1912.

*The New China: A Traveller's Impressions.* By Henri Borel. Translated from the Dutch by C. Thieme. With 48 Illustrations. Demy 8vo. Pp. 282. *Price* 10*s.* 6*d. net.* London: T. Fisher Unwin, 1912.

*The Normandy Coast* (County Coast Series). By Rev. Charles Merk. Illustrated. Demy 8vo. Pp. 370. *Price* 6*s. net.* London: T. Fisher Unwin, 1912.

*The Voyage of the "Discovery."* By Captain Robert F. Scott, C.V.O., R.N. With Illustrations and Maps. A re-issue. In two volumes. Demy 8vo. Vol. i. pp. xvi+410. Vol. ii. pp. x+387. *Price* 7*s. net.* London: Smith, Elder and Co., 1912.

*The Junior Scientific Geography.* Book v.: The Monsoon Region of Asia. By Ellis W. Heaton, B.Sc., F.G.S. Crown 8vo. Pp. 87. *Price* 10*d. net.* London: Ralph Holland and Co., 1912.

*The Student's Handbook of Stratigraphical Geology.* By A. J. Jukes-Browne, B.A., F.R.S., F.G.S. Second Edition. Illustrated with Maps, Diagrams, and Figures of Fossils. Crown 8vo. Pp. xiv+668. *Price* 12*s. net.* London: Edward Stanford, 1912.

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# THE SCOTTISH GEOGRAPHICAL MAGAZINE.

## THE STORY OF THE FORTH.

By H. M. Cadell of Grange.

*(With Illustrations.)*

### I.—Introductory.

From its first beginnings in the remote ages of the geological past down to the more recent and better known times of the archæologist, the River Forth has had an interesting and chequered career. The story of the Forth is indeed a long one, and it is not possible now to do more than attempt to draw some rough and general outlines of what observation and theory lead us to suppose has happened at a few separate periods in the life of the river.

The ways and habits of streams and running waters have been much studied by geographers in recent years, but it may be well, for the benefit of any not specially versed in the lore of physical geography and geology, to begin the argument, like Euclid, with a few elementary postulates and axioms, so that there may be a clear understanding of the reasoning on which the conclusions in the following pages are founded.

Nature is a thing of law and order, and although it may not always be very apparent at first sight, it is the fact that law and order prevail among the living waters of the earth as well as among the inhabitants of the plant and animal kingdoms. When a river is found apparently disobeying some general law and following an irregular and abnormal course, then the philosopher may with profit consider the matter and try to ascertain the why and wherefore of the unusual phenomenon and what lessons it may have to teach.

When, for example, rain falls on a sloping roof it naturally runs

straight down to the rhones, and after a shower if we were to notice that it had apparently run obliquely across the slates or even up towards the ridge we should, no doubt, be much surprised and anxious to trace the cause of such a remarkable and unnatural phenomenon. Now in the case of a river its natural course is a straight line by the shortest route from the watershed to the sea. The original surface of the land after it was first upheaved from the sea, where the solid rocks mostly all originated, was covered with streams all running more or less in the direction of its greatest declivity. By and by the rills began to coalesce into a few larger streams with shallow valleys and tributaries. The tributaries ran towards the sea and the main river, and joined the trunk at a more or less acute angle above the confluence. A normal river is thus like a well-developed tree with branches growing upwards from the stem and stretching towards the light of heaven. Some branches may get more light and become stronger than others, and some tributaries may receive more rain and grow larger than others, until in time the young and symmetrical figure grows into a distorted old patriarch with almost no resemblance to its original form.

These may seem truisms too obvious to be worth mentioning, but as we follow the argument the use of referring to them may soon become more apparent. As time goes on the glens grow deeper and larger, and their rivers acquire a prescriptive right of way that becomes ever stronger with the lapse of centuries. Each river has a valley, and there are no dry valleys that have not once been occupied by a river except in a very few abnormal cases. If we find a dry valley it is a proof of some change of circumstances, and to this point we shall return later on.

Now it must not be forgotten that the rivers have made the valleys, and it is not the valleys that have determined the courses of the rivers. The valleys in this country are not due to cracks or sinkings of the surface of the earth's crust—a fact that is easily proved by a little investigation. There are no doubt many cracks and fissures in the rocks, but these run across the country in more or less straight lines, and are never found to wind about like the tortuous meanderings of river beds, nor do they branch from the main stem and subdivide again like the tributaries of a river system. No doubt fissures are occasionally to be found running along the beds of straight river courses for some distance, but this is because fissures mark lines of weakness and broken rock, along which running water, if it happens to be flowing in the same direction, finds it easier to excavate a channel than at places where the rock is quite undisturbed and solid.

The next point to be noted is the two ways in which the rock is worn down. Streams eat their way both downwards into the rock and backwards into the hills. The Cauldron Linn, for example, shows a stream busily engaged in sawing out a notch in a hard dyke of basalt that crosses the Devon below the picturesque gorge at the Rumbling Bridge. The sand and gravel brought down from the Ochils in the course of centuries has enabled the water to grind away part of the barrier, and as soon as the hard rib has been entirely sawn through, the fall will recede into the softer sandstone above the dyke and still further

deepen the ravine up stream. The fall will eat its way back into the hills, and the more water and gravel that comes down the faster will the recession go on. When the water is low and clear there is practically no erosion, but when the stream is in spate, and full of heavy grit and

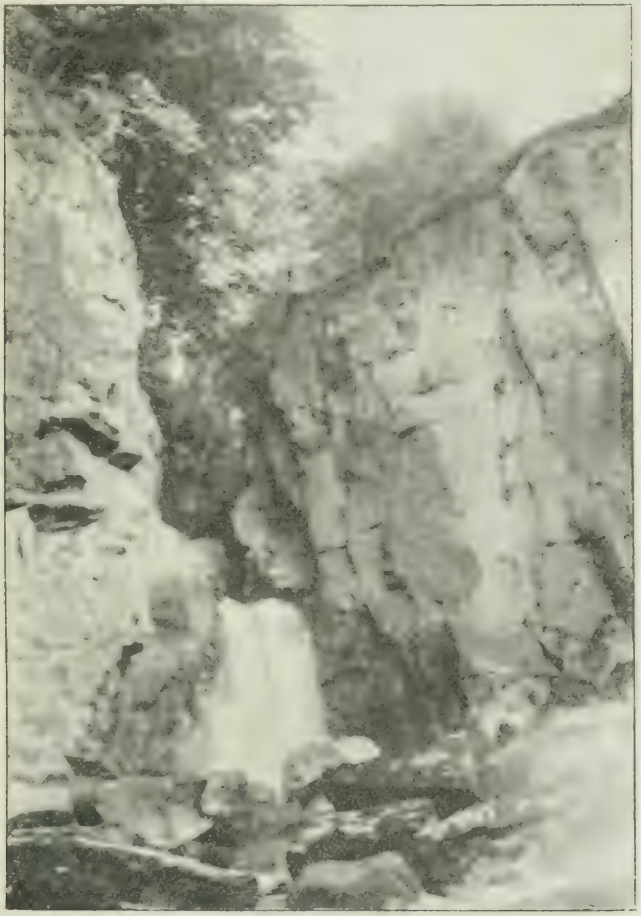

Fig. 1.—The Cauldron Linn.

sediment, it goes on grinding merrily, like a lapidary's wheel with plenty of diamond dust (Fig. 1).

It is a far cry from the Cauldron Linn to Niagara, but here we see the same process at work on a vastly grander scale. The classic American river has been for centuries eating its falls backward from Lake Ontario towards Lake Erie, and from 1842, when measurements were first made, the falls had retreated, up till 1905, a distance of 265 feet, or at the average rate of a little over 4 feet per annum. Had the water

been turbid and full of sediment the rate would no doubt have been much more rapid, but, issuing in a clear and limpid stream from the great lake above it, it can only work on the rock by undermining the soft shale under the limestone ledge, which falls in great blocks and is ground to powder in the vast cauldron beneath. So rapid is the recession in spite of this want of sediment that the Canadian Fall, formerly known as the Horse Shoe, has completely changed its form, and is now like a

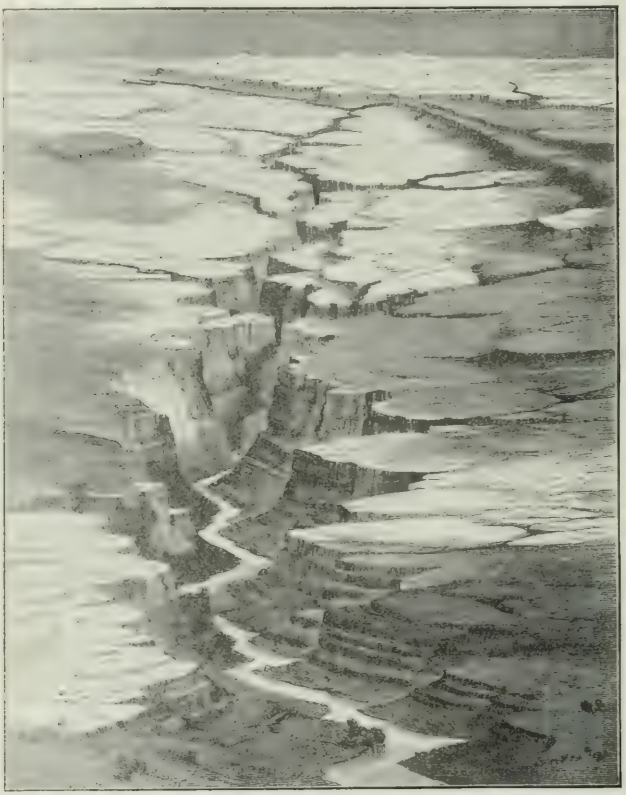

Fig. 2.—The Colorado Cañon.

sharp letter V pointing up stream. It is much less picturesque than when I first visited it twenty-one years ago, and the remarkable power of the cataract in tearing away and removing the hard rock is most impressive.

From Niagara to the Grand Cañon of the Colorado in Arizona is another far cry, but if we turn to that remote wilderness of the Far West we find a still more impressive example of the erosive power of running water, this time, however, far from blue and limpid. The Colorado River has for ages been running like the Nile from a rainy country across a dry desert plateau made up of flat beds of more or less soft rock

of brilliant and variegated tints. It has cut its bed down through several geological formations to a depth at places of more than 5000

FIG. 3.—The Nile at Bab-el-Kalabsha.

feet. The seething stream far down at the bottom of this awful abyss is nothing but a rolling mass of sand and mud liable to sudden floods and changes of level and colour. When I was down the cañon in 1891 the water was comparatively low and had the colour and consistency of

pease soup. The rocks were evidently being rapidly ground down and rolled along in pieces that would soon be broken up and washed away in grains to the Gulf of California. No intelligent person who has ever seen that marvellous river can doubt for a moment that its gorge has been scooped out in the past by the same processes as are still engaged in its excavation.

The illustration (Fig. 2) shows the zig-zag line of the cliffs and valley of erosion as contrasted with the straight lines of the cliffs of elevation which follow the course of fault fissures in the plateau.

To change the scene once more, there are rivers that not only deepen their valleys but scoop out enormous holes in them, so that were they to be temporarily dried up, their course would be marked by chains of deep

Fig. 4.—The second defile of the Irrawaddy.

and narrow lakes separated by dry spaces or ridges of rock. The Nile at the Bab-el-Kalabsha, about 30 miles above the great dam of Assuan, runs between granite walls of no great height, but these drop perpendicularly into water 18 fathoms or 108 feet deep, much below the level of the granite at the dam. The hard sand of the desert is blown into the river and swept along the bottom first downwards and then upwards as the water shallows, so as in course of time to grind out a long, deep trough which can be produced in no other way than by multitudes of hard grains constantly being dragged along by the powerful current (Fig. 3).

A still more striking example of this phase of stream erosion which I have noticed in the course of my travels is to be found in the second defile of the Irrawaddy in Burma, a river whose valley is less known, but at some places far more picturesque than that of the famous water

of Egypt. The Irrawaddy at the second defile, about 600 miles above Rangoon, crosses a range of mountains 4000 feet in height, and as the surface of the water is only 300 feet above sea-level the gap in the mountains is about 3700 feet deep. The river bed in the centre of the defile is full of enormous holes, some of them 27 fathoms, or more than 160 feet, in depth, produced as in the Nile by the swirling, surging current dragging along the grit and soil that is constantly being washed down from the shoals and jungle-clad alluvial banks upstream (Fig. 4).

Let us now come a little nearer the proposition under discussion, and, leaving these far-away rivers, consider for a few minutes another and more theoretical part of the question, arising, however, out of what we have been observing, and relating more closely to what falls to be observed at home. To make the subject abundantly clear I have drawn diagrams showing two model rivers, A and B, at four successive stages in their hypothetical history. (See Plate I.)

Each river has ten tributaries, five on either bank. River A on the left flows over soft strata that constitute the greater part of the original sloping plateau. River B, let us suppose, has the lower part of its course on hard solid granite, tinted darker on the plan, and hatched in section. The granite area being much more durable than the stratified part of the plateau, B will not be able to deepen its bed nearly so fast as A, and the tributaries of A will therefore eat their way downwards and backwards at the greater rate, as shown in the second figure. By and by the lowest of A's tributaries on the left bank may push its way backwards, say along the line of junction of the hard and soft rocks, which may be a fault fissure easy to excavate, and will in time succeed by virtue of its greater declivity in eating into the water-parting and tapping the headwaters of the nearest of B's tributaries. Nothing succeeds like success, and being thus reinforced with more water, this invader of B's territory may go on and next succeed in tapping the upper part of B's main channel, and end by finally decapitating B altogether and drawing off half of its water into A's domain. B will thus become weaker and weaker, and A will wax in the same proportions as B wanes, and the lowest enterprising tributary of A may end in growing greater than the parent stream itself, as shown in the next figure. This tributary may grow so deep as to end in finally tapping not only B's headwaters, but any part of B's basin it can reach, and in this way the final state of matters will be that the second of B's tributaries on the left bank may be diverted into A's basin, leaving B in a miserable condition with hardly anything to live on but fond memories of departed greatness.

The original course of the main river is described by physical geographers as *consequent*, as it is consequent on the original direction of slope. The course of the later tributaries joining it is similarly known as *subsequent*, but sometimes, as we shall see afterwards, rivers flow in a third direction, neither consequent nor strictly subsequent in the sense now used. In the last figure the second tributary of B on its left bank will be seen to have been tapped, so that the water near the confluence with the subsequent tributary of A runs in a direction against the slope of

the plateau and *opposite* to the original direction of flow of river B. A stream that has thus reversed its course is said to have become *obsequent*, a useful term first proposed by my friend, Professor W. M. Davis of Harvard. It is clear that in time A might become so deep as to draw off the whole of B, and in that case the lower part of B would run backwards against the original direction of slope, and the river become entirely obsequent. Good examples of obsequent streams are to be found in various old river-systems, and particularly in the basin of the Forth and Clyde, to which we shall now return.

This area also comprises fresh- and salt-water lochs of great beauty and interest, not only to the tourist in search of scenery and sport, but to the merchant in search of business and the scientist in pursuit of knowledge. These lochs, all more or less long and narrow, are often far deeper than the sea outside, and although mostly outside the Forth district have, as we shall see, a distinct place in the history of that river.

From the point of view of the geological historian, lakes, however they may have originated, are only to be looked upon as temporary and evanescent features of the ever-changing landscape. They constantly receive from the surrounding hills and glens streams of turbid water full of sediment, but the outflowing river is always clear and limpid, all the detritus having been separated in the calm water and left behind as in a filter. Filters, however, become choked up in time, and so do lakes, and the whole country is dotted over with old lake beds that have become overgrown with peat or silted up, many of them within quite recent times. Their outlets have also been deepened by the effluent streams, and the shallower ones may thus have been often drained quite dry. Many countries, like the United States, India, and Australia, have perfectly dry scenery with none of the glittering spots of fresh water that add so much to the attractiveness of the Scottish landscape.

It is only in countries where lakes have been produced at a comparatively recent time that they still exist in large numbers. Time was when there was none in Scotland, or at least very few in our upland glens and straths, but the Great Ice Age arrived and passed slowly by, covering the land like Greenland with a mantle of solid ice and snow, and when at last the glaciers melted away and the frozen flood subsided, the worn face of the land appeared once more to view, but now all flecked over with bright streaks and pools of shining water.

Countries that have been under ice, such as Canada, Scandinavia, Finland, and Patagonia, are sprinkled over with countless numbers of lakes and tarns, which have some relation to the local river-systems. As rivers of water scoop out hollows in their beds, so do rivers of ice in their valleys, especially where these are narrow and constricted, but ice being much more solid than water, has power to grind down its channel far more effectively. Besides this, the pressure on the bed of a glacier hundreds or even thousands of feet thick, as many of the Scottish glaciers must have been at one period, is far greater than that which the largest river can bring to bear on the gravel it is sweeping along. No doubt, as we have seen, if rivers were to dry up, as they often do in Australia,

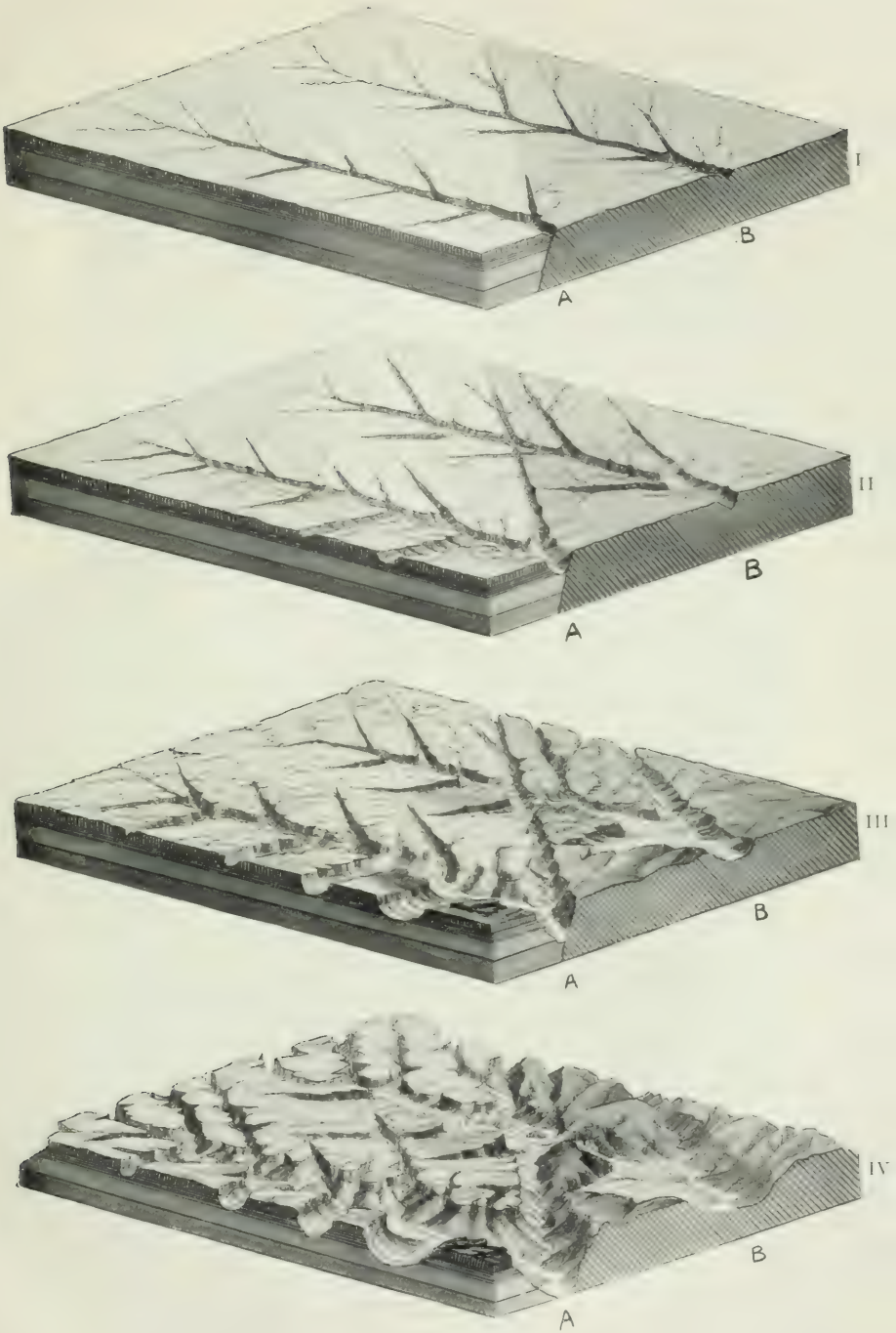


PLATE I.—Four stages in the development of a river system.

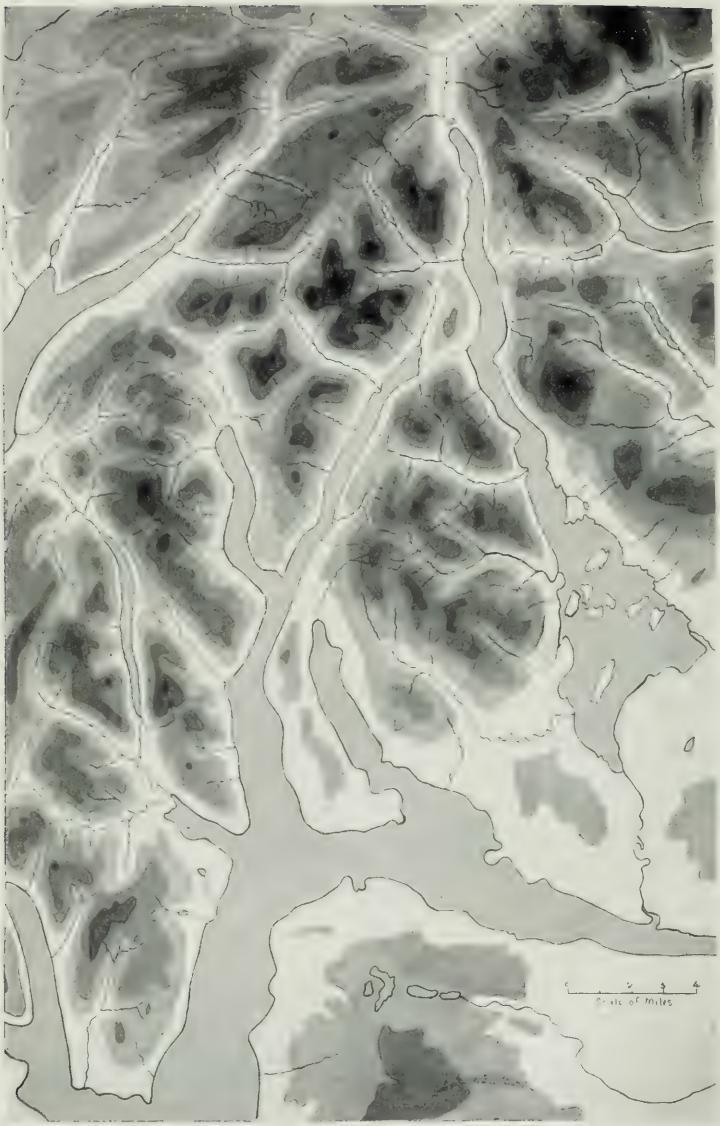

PLATE II.—LOCH LONG AND LOCH LOMOND DISTRICT, SHOWING VALLEY SYSTEM.

The regions left white are under 500 feet above sea-level, and each gradation of tint represents a rise of 500 feet.

chains of lakes and pools would be found scattered along their track, but these would be quite insignificant compared to the deep basins in rocks where ice has been at work. The glaciers merely accentuated and deepened the old river valleys, but did not produce new ones. The rivers were on the ground long before the glaciers, which were only temporary tenants that appeared on the scene and occupied the valleys during an important but limited period. While the ice prevailed the rivers' work was suspended and their ordinary habits were changed, but only for a time, to be quickly resumed as soon as the climate again became normal.

It is thus apparent that, except for the rivers, the ancient Scottish landscape was a dry one, and we may leave the lochs out of account and consider them filled up and their beds no more conspicuous than other parts of the glens during the earlier chapters in the ancient history of the Forth.

## II.—The First Beginnings of the Forth.

While engaged on the staff of H.M. Geological Survey, mapping the rocks of the Dumbartonshire Highlands in the district of Loch Lomond and Loch Long, many years ago, my attention was drawn to what seemed a singular feature of the whole river system in that part of the country. The subject had apparently never been discussed before, and I ventured to explain the hypothesis that suggested itself to me in a short paper in the *Scottish Geographical Magazine* for 1886. The general conclusions then arrived at still seem perfectly sound, and in view of the fresh knowledge we now possess of the geographical conditions and facts relating to the physical history and development of rivers and river systems, which have been carefully investigated in recent years by many eminent observers, it may be of interest to return to the subject and pursue it a little further now.

This district, it is to be noted, is not situated within the existing Forth basin, but is entirely drained by the Clyde, and therefore may appear at first sight to have nothing whatever to do with the valley system of the eastern river. On closer scrutiny, however, some important peculiarities soon become apparent, which, as we follow up the line of investigation, lead us to conclude that notable changes have taken place in the local river systems since the stream originated in the middle of the Tertiary age, and that this part of the Argyllshire and Dumbartonshire Highlands had in fact a great deal to do at one time with the Forth and its many tributaries.

On glancing at the map (Plate II.), two topographical features at once arrest our attention in the mountainous district of Cowal and Dumbartonshire, between Loch Lomond and Loch Fyne :

1. With the important exception of the Loch Long depression, the main valleys and glens, including the upper part of the Clyde, have a general trend towards ESE. or SSE.

2. The watersheds between what are now the main valleys are not situated midway between but close to the eastern sides of these glens.

The country between Loch Lomond and Loch Long is a triangular plateau of clay-slate and metamorphic schist, with twelve principal mountains varying in height from about 2000 to 2400 feet, separated from one another by deep glens. The deepest and shortest of these is the narrow pass between Arrochar and Tarbet where the two lochs nearly meet, and the neck of land between them, $1\frac{3}{4}$ miles in length, is at the highest point only about 160 feet above sea-level. This remarkable gap across the high plateau is not occupied by any stream of importance, and if it is due to erosion it must have been excavated by some stream long ago cut off or dried up. It may be mentioned that two basalt dykes have been traced along its course running in an ENE. direction from Argyllshire to the Loch Lomond ridge. These dykes have perhaps decomposed more easily than the metamorphic rock, and have no doubt been instrumental in directing the course of the original stream and giving the pass a more northerly trend than the other glens leading to Loch Lomond which we shall now notice.

Four and a half miles below Tarbet we come to Inverbeg, at the mouth of Glen Douglas, where the Douglas Water enters Loch Lomond at a small alluvial delta projecting from the foot of the steep mountain slope into the deep water. The Douglas Water has a comparatively straight course of four and a half miles, and Glen Douglas, which forms the second gap through the mountains, is only five miles in length between Loch Lomond and Loch Long. The highest point in the glen is about 500 feet above sea-level, and only half a mile from Loch Long. The surrounding mountains are over 2000 feet in height, and the glen is therefore cut right through them to a depth of over 1500 feet. The watershed is along the ridge of Creagan Hill, and on the actual slopes of Loch Long, and the tributaries of the Douglas first flow down the western sides of the mountains towards the sea, but, urged by some mysterious force, they turn eastwards towards Loch Lomond through the deep cut of Glen Douglas, although their course is thus lengthened by four miles. The West Highland Railway along Loch Long approximately follows the watershed at this place, and the observant passenger can get a short glimpse of how the streams run from Loch Long right down Glen Douglas to Loch Lomond.

Glen Luss, about three miles further south, is likewise trenched right across the plateau, but not to such a depth as Glen Douglas. The Luss Water from mouth to source has a course of about six miles as the crow flies, and its head tributaries rise about a mile and a half from Loch Long.

Glen Fruin again has the same south-easterly trend, but is a longer and wider valley. The Fruin Water rises about a mile from Gareloch-head, and two miles from Loch Long, and reaches Loch Lomond at Arden after a course of ten miles.

The next valley to the south of Glen Fruin is the submerged trough of the Gareloch, once doubtless the line of a river that ran in the same direction. To this we shall return again.

The Dumbartonshire glens thus agree in ending in a water parting close to the shore of Loch Long, and in having streams that all flow in

an easterly or south-easterly direction in deep and well-defined courses through the plateau.

If we now cross Loch Long into "Argyle's Bowling Green" and the adjacent rugged mountainous coast of Argyllshire, we find the same physical peculiarities in evidence. The water parting hugs the east shore of Loch Fyne, and the glens are trenched through the heart of the mountains in such a way that the streams flow away south-eastwards towards Loch Long, and, with the exception of the Kinglas Water, no considerable stream is seen to run in a westerly direction to the Loch Fyne Valley. The most conspicuous case is that of the River Cur, which drains the country south of Loch Goil, and enters the Clyde at the head of the Holy Loch. This stream, after following a steep mountain course to the south-west for four miles, reaches a point near Strachur less than 150 feet above sea-level, and only half a mile from the shore of the loch. Urged eastward by the same apparently inscrutable principle, instead of flowing on to Loch Fyne and reaching the sea by the shortest path, it wheels sharply round to the left, and turning its back on the coast, plunges into the deep defile of Loch Eck, a glen which joins the Loch Long valley at the mouth of the Holy Loch, fourteen miles from the turning-point at Strachur. This defile is very narrow, and is excavated almost to sea-level through a mountain plateau over 2000 feet in height. The level of Loch Eck is only 67 feet above the sea, and the bed of the valley, now partly filled by alluvium, is no doubt considerably below sea-level for a long distance up.

Loch Goil occupies the next cut through the plateau north of the Holy Loch. The valley ends in Hell's Glen, a deep defile whose highest point is about a mile and a half from Loch Fyne and a little over 700 feet above sea-level. This trench is not so deep or long as that of Loch Eck, but it has one peculiarity of note. It abuts on Loch Long in such a way that its axis is in line with that of the Gare Loch, which suggests that the two were originally one valley.

Glen Croe, the northmost of the side glens on Loch Long, also forms part of a deep defile through the ridge to Loch Fyne. But in this case there is another equally large stream at the west end—the Kinglas Water—and the water parting at Rest-and-be-thankful is midway between the two sea lochs. Glen Croe is very deep and narrow, and skirts the south side of Ben Arthur (the Cobbler), which is nearly 2900 feet in height. The mountains at the head of Loch Long and Loch Fyne form the highest ground on the west side of Loch Lomond, and Ben Ime, the tallest of the group, is 3318 feet in height. The rainfall on their crests is large, and the streams where steep have considerable erosive power.

Loch Long ends at Arrochar in Glen Loin, which runs northward for three miles, and if produced a mile or two further would strike straight into Loch Lomond. But here another circumstance falls to be noted. Glen Loin is crossed at right angles by the Inveruglas Water, which truncates the apex of the triangular plateau and discharges into Loch Lomond. This stream rises in the wild granitic plateau

beyond Loch Sloy, and runs south-eastward for 3 miles in a deep V-shaped glen between Ben Vorlich and Ben Vane. Loch Sloy (Fig. 5), the former home of the "wild Macfarlanes' plaided clan," occupies a mile and a quarter of the glen. It is 812 feet above sea-level and 2280 feet below the crest of Ben Vorlich. The lochan is a lonely and desolate streak of water overhung by barren mountains and studded round with the moraine heaps of the old glaciers that once covered the plateau, radiated out into the glens, and finally melted away long before the wild clansmen likewise radiated into the low country, gradually melted away, and at last disappeared from the

Ben Vorlich. FIG. 5.—Loch Sloy. Ben Vane.

inhospitable region. This little corner is mentioned, as it will be found to illustrate a point in the process of development of the river system to which reference will again be made.

On the east side of Loch Lomond, exactly opposite the line of the Inveruglas Glen, the Arklet Water enters the valley at Inversnaid. Glen Arklet is a little over four miles long from Inversnaid to Loch Katrine, and forms the only deep gap through the Ben Lomond ridge. Loch Arklet is 463 feet above sea-level, and the ground to the north of it is more than 2100 feet high. The gap is thus cut some 1600 feet down into the ridge, and this, like the other facts that have been cited, is, as we shall see, a point of some significance in the topographical history of the district. (See Plate IV.)

When we come over to the south side of the Firth of Clyde above

Gourock we find the same eastward trend of the principal tributaries and glens, which generally run more or less in the opposite direction to that of the main river. The Gryfe Water, which rises at the head of Strath Gryfe, a little more than two miles south of the Clyde at Port Glasgow, instead of flowing northwards down the steep slope by the shortest route to the sea, takes a long eastward journey in an independent glen of its own to join the River Cart, which enters the Clyde near Renfrew, about twelve miles further up.

The Black Cart Water, issuing from Castle Semple Loch, flows north-eastwards for eleven miles, along a deep and well-marked gap used by the Glasgow and South-Western Railway, which runs straight through the Renfrew hills from Johnstone to Kilbirnie and Dalry. At the watershed the bottom of the gap is only about 200 feet above sea-level, while the hills on the north-west side of the glen rise to heights of over 1000, and those to the south-east to over 800 feet.

Four or five miles further east the ridge is crossed by another smaller trench running also north-eastwards past Neilston and Barrhead, 300 to 400 feet deeper than the surrounding country. This is occupied by the Cowden Burn, a small tributary of the White Cart. The line of this gap, if produced, would cross the Clyde at Rutherglen and make an acute angle with the main river below the confluence, instead of the obtuse angle that would be natural in a normal tributary.

If we now visit the country between the Forth and Clyde we again find in the Campsie ridge evidences of an older and comparatively disused river system. The first feature in the district is the well-marked narrow trench that crosses the country in a straight line between Clydebank, Kilsyth, and Larbert. This channel is occupied by two insignificant streams, the Kelvin flowing west towards Glasgow, and the Bonny Water, a tributary of the Carron, which runs eastwards and enters the Forth at Grangemouth. These two streams rise at a place called Kelvinhead, two miles east of Kilsyth, where the height of the valley bed and the water parting of the country is only about 150 feet above mean sea-level. This remarkable gap is used for the Forth and Clyde barge canal, and is one of the routes suggested for the proposed ship canal across Scotland. It is not produced by faulting of the strata, and is evidently the work of an ancient and swift river with great erosive power, well able to excavate a deep gorge in hard rock, which the puny streams that now wimple gently along the hollow could never have done.

If we prolong the line of this valley to the west, it is found to run exactly in line with the gap we have just noticed in the Renfrew hills at Castle Semple.

The Campsie and Kilpatrick hills, which form the south-western continuation of the long Sidlaw and Ochil range, consist of great flattish terraces or beds of hard volcanic rock resting on softer sedimentary strata. These separate plateaus evidently form the detached parts of what was once a single long flat-topped ridge or table-land stretching away northwards from what is now the Kelvin and Bonny valley to the

base of the Highland mountains. The plateau has been worn away by the Forth on the north, and bisected in the centre by Strathblane, a deep, broad glen that runs south-eastwards almost exactly in a straight line with the eastern side of Loch Lomond. Strathblane extends southwards past the village of Campsie and Lennoxtown and joins the Kelvin Valley west of Kilsyth. The watershed is at Ballagan, near Campsie, and the western end of the glen forms the course of the Blane, a small stream running westwards into the Endrick, which enters the east corner of

Fig. 6.—The Clyde river system.

Loch Lomond at Buchanan Castle. The height of the watershed is a little over 250 feet at Campsie, and, as the adjacent Strathblane hills are over 1600 feet in height, a breach more than 1300 feet in depth has been cut in the plateau long ago by some river of more importance than any of the existing local burns. The excavation of this breach in the plateau has been originally facilitated by a large fault which runs obliquely across it and has produced a line of weakness like that in the Forth valley at Stirling.[1]

[1] An interesting account of the changes in the local drainage system of the Campsie plateau is given by Mr. E. B. Bailey in the *Geological Survey Memoir of the Glasgow District*, 1911, pp. 198-201.

Now it is possible, I think, to fit these data together, and to construct the general framework of the story they have to tell. An inspection of the accompanying map of the Clyde river system shows it to be altogether abnormal and irregular, quite unlike the plan of a consequent stream following a definite course to the sea (Fig. 6).

In the part of the country under consideration the principal rivers and valleys are thus seen to follow a general easterly, south-, or north-easterly course, but with one notable exception—the Clyde, which flows in exactly the opposite direction. The Clyde is apparently an obsequent river above Gourock, and the Glasgow district is evidently the site of an ancient battlefield between two contending rivers, such as A and B in Plate I., where the Clyde has, like A, become the victor, and brought the long struggle to an end by decapitating the Forth, and greatly diminishing its former grandeur. The Clyde has been the Highland robber and the Forth the Lowland sufferer by this ancient invasion from the wild West. A large part of the original territory of the Forth, some 1200 square miles in extent, has apparently been cut off, and the water drawn aside from its ancient channels.

When first I suggested in 1886 that the Clyde and its tributaries originally ran into the Forth, some geologists in the West were offended at the notion that the Clyde was a usurper and the predatory habits of Dumbarton and Argyllshire dated back to such a remote antiquity—habits that, once formed, lingered for ages before they were finally eradicated. But a quarter of a century has not altered my opinion, and, indeed, the study of other river systems has only served to strengthen it. To make a long story short, the appended map (Fig. 7) indicates what I believe may have been the general outline of the river system of the Forth, if not at the very beginning, certainly at an early stage in its career, when the valleys were several hundreds of feet shallower than they are in our time.[1]

The excavation of the original valleys dates from a considerably later time than the Miocene age, but, as we have seen, they were in existence long before the Glacial period. In surveying the high ground at the head of Loch Lomond I once traced a large basalt dyke right across the Loch Sloy defile and over Ben Vorlich, at a height of 2950 feet. Now this dyke, which is only one of many in the district, was injected from below into a fissure which ran eastwards across the country towards Loch Katrine, at a time when the deep valleys had no existence, otherwise the molten lava would have escaped at the lowest point, flooded the valley beds, and never reached up to the top of the plateau. The glens have thus, like teeth cut in a saw, been notched out of the basalt veins since the Miocene age, when volcanoes were numerous in the western isles, and multitudes of dykes were injected into cracks in

[1] My old friends and former colleagues, Messrs. Peach and Horne, in their account of the Scottish Lakes in the *Report of the Bathymetrical Survey* by Sir John Murray and W. L. Pullar (1910), refer at pp. 465-6 to the origin of the Forth and Clyde valleys, and offer a somewhat different explanation of their early history. No doubt there is room for discussion, but I still venture to think my old riverbeds will hold water, if not at every loop, at least in most of the deepest pools.

FIG. 7.—Map of the probable ancient river system of the Forth.

the Highland plateau. The Ice Age intervened after the rivers had excavated their valleys, and although, as we shall see, the glaciers produced important changes, they were not instrumental in producing the valleys themselves.

The ancient Forth and Clyde watershed at the period in question was evidently along a range of mountains west of Loch Long. This range formed the seaward boundary of the north-west of Europe, and must have been much higher and more imposing than the half-submerged fragments that now remain. The western sea lochs were then river valleys, and the Firth of Forth the bed of a great river flowing far beyond the mouth of the present estuary. The great size of the Firth of Forth, which forms the most conspicuous notch in the coast between the Moray Firth and the Thames, shows how large the ancient river must have been at one time.

But here the reader may well ask: "How do you know that the long trough of the Firth of Forth was not really produced by a bending down or subsidence of the land?" To this very reasonable objection I reply, "See how the Carron, Avon, Almond, Water of Leith and other main tributaries run in an easterly or north-easterly direction, and not straight northwards by the shortest route to the sea. Had there been a sinking down of the land to produce the main valley, the water would have run down the declivity like rain on a roof perpendicularly to the contour lines and not at an oblique angle or nearly parallel to them." No, the trend of the side valleys is clearly the result of some widespread original cause that has stamped permanently on the face of the country the pattern of the first river system.

There was one important difference between the eastward and the westward flowing waters. Those flowing west had not nearly so far to go as those flowing eastwards, to their ultimate oceanic destination. The consequence was that the latter, flowing at a lower gradient, had probably less velocity and therefore less erosive power than the former. In this case, unlike that illustrated in the diagram, it was thus not the greater hardness of the bedrock but the lower gradient, that put the Forth at a disadvantage in the struggle for supremacy with the Clyde. Then again most of the rain clouds which come from the Atlantic would condense on the part of the range next the coast, and so the westward flowing streams would receive at their sources more water than those in the drier eastern region.

The ancient Clyde and its tributaries would thus have most erosive power, and be best able, when fairly started, to eat back into the borders of the plateau originally in the Forth domain, and when once the invader became strengthened and the defender weakened by these conquests, the process of acquisition would become ever easier.

We are not now concerned with the part of the Clyde valley below Wemyss Bay. Let us suppose a large river running southwards off the plateau towards the Irish Sea, with its head tributaries in Loch Striven, the Kyles of Bute, Loch Fyne, and the Clyde valley below Dunoon. Each of these, well replenished by the heavy rainfall, like Niagara on a small scale, ate its way back into the mountains, slowly at first, no

doubt. The eastmost branch gradually managed to work back and northwards till it crossed and penetrated the soft sandstone on the watershed at Dunoon and tapped the headwaters of the eastward-flowing tributary of the Forth, now the upper part of the Firth of Clyde. The bed of the eastward-flowing river, with its long seaward course, was no doubt situated at a higher level than that of the invading river, and probably occupied a comparatively flat valley. When once it was tapped at the head the whole drainage of the Loch Eck valley was diverted southwards into the thriving Clyde. The additional volume of water increased the flow of the river, and this tributary became more important than its next neighbour at Loch Striven, and went on deepening its course and extending its territory. To make the subject as clear as possible, the accompanying imaginary bird's eye view is intended to show what may have been the general appearance of the ancient Forth and Clyde valley at this stage, when the Clyde was about to break through into the Forth basin near what is now Dunoon. (Plate III.)

The original slope, while it determined the general direction of flow, was not the only factor in shaping the trend of the river courses. The rocks might be so inclined, and the land surface so grained, that the work of excavation became much easier in some directions than others. If we try to draw the point of a nail obliquely across the grain of a fir-board, the moving point will describe a series of zig-zags—the result of the struggle between the draughtsman's hand and the lateral resistance of the fibre of the wood to a point drawn obliquely across it, and this will illustrate the operation of the forces determining the minor changes in the directions of the valleys.

In the several parts of the district there is evidence of such a struggle having taken place in the early days of the river valleys. The water was trying to flow south-eastwards, and the strike or grain of the plateau, particularly in the Cowal area, was towards the SW. or SSW. The tendency was therefore to deflect the stream towards the south. This is best seen in the Cur valley, which has all the appearance of having originally extended in a perfectly straight line from Strachur to Ardentinny at the mouth of Glen Finart. Glen Finart ends in a wind-gap at the bend of Loch Eck, and the lower part of Loch Long is probably the south-eastern prolongation of the original valley. The Holy Loch and Glen Massan may have been another parallel valley at first, but owing to the grain of the rock between these valleys, the Cur found it easier to abandon its original track and bend in a more southerly direction towards Glen Massan. This geological feature, combined with the prevailing tendency of subsequent streams to run southwards, appears to have made the recession of the falls in all cases greatest towards the north, and all the invaders accordingly traversed the Forth and its tributaries in that direction. The lower part of Loch Eck is thus probably on the course of an original tributary of the River Massan which ate its way northwards and stole the headwaters of the Finart at an early stage. The decapitated Finart was thus unable to do much digging, and the Loch Eck defile became the principal glen.

The advancing Clyde next pushed out an arm northwards and suc-

PLATE III. -Bird's-eye view from the supposed ancient watershed of the Forth and Clyde.

ceeded in cutting off the upper part of the Loch Goil and Gareloch river, and, following the line of one of the numerous joints or weak places on the site of Loch Long, it apparently cut off a small piece of the head of Glen Douglas, which remains in Coilessan Glen, and finally reached Ben Arthur and diverted the Glen Croe Water into the lower channel, drying up the gap leading to the Loch Lomond valley at Tarbet.

Now I need scarcely say that it is not easy, particularly for those who have not made a special study of such matters, to picture to the mind how all this has taken place, nor to realise the vastness of the time these operations involved, but all the circumstances seem to show that this has undoubtedly been the general course of events in the evolution of the valley system of the district.

The last stream to be cut off was the Glen Croe Water, and this is no doubt the reason why the gap at Arrochar is the deepest that crosses the Dumbartonshire Highlands. The River Croe had more time to work down its bed before it was decapitated, or rather curtailed, and had therefore excavated its glen to a greater depth than the other streams. When the River Cur was curtailed its glen was no deeper than the top of the wind-gap at Whistlefield above Garelochhead, 320 feet at least above the present sea-level, but the bottom of the old Glen Croe between Arrochar and Tarbet only rises to a height of 160 feet. Since it was dried up it has probably not been reduced much in height, as it has no important streams to wear it down, and the glaciers that deepened the other glens flowed across and not along its axis.

Although the Loch Long glen is nearly all submerged, it is still possible to trace the same process of erosion going on in Glen Loin, its northern prolongation beyond Arrochar, and this helps to illustrate the method on which these glens seem to have been originally formed. The head of the valley for a mile above Arrochar is filled up with the alluvium of the stream which, instead of eroding, is here depositing a delta at sea-level. Could the land be lifted and the valley again dried up, a waterfall would at once be produced in Glen Loin which would work its way up the glen towards Loch Sloy. But out of Loch Sloy there is another stream, the Inveruglas Water, running eastwards across the course of Glen Loin into Loch Lomond. Now there will be a competition between these two streams as to which one can deepen its bed fastest, and in this connection another circumstance must be noted. The surface of Loch Lomond is at present about 23 feet above sea-level, and so long as it thus remains above the level of Loch Long, the streams running into the sea-loch will have the advantage over those flowing to the inland basin of so much more of a fall. In course of time the Inveruglas Glen will be worn down nearly to the level of Loch Lomond, but deeper it cannot go unless Loch Lomond also subsides. At the same time the Loin Water will continue to lower its glen, and if, as we have supposed, the land were to be upheaved so as to dry up Loch Long, but not Loch Lomond, which is an inland lake, the work will be hastened and the Loin will at last break through the watershed and draw off the Inveruglas to the south. The Long valley will thus be deepened for three miles, and

the last mile of the Inverugias Glen will be dried up, leaving a deep, short wind-gap similar to the one at Arrochar and Tarbet. The Loin, thus reinforced by the much larger volume of the stream issuing from Loch Sloy, will receive a fresh lease of life and will go on eating back its glen into the mountains, and finally draining the little lochan entirely away. Thus in the remote future Loch Long might, especially if a slight submergence were to occur, be found to have pushed its way far back through the defile between Ben Vorlich and Ben Vane into the plateau west of Ardlui.

In all this district the massive metamorphic schists are intersected in different directions by great vertical master joints, and no doubt the very straight course of Loch Long is partly due to these lines of cleavage running parallel to the valley. The steep mountain slopes are often covered with immense blocks and heaps of rock that have slipped down in large slices, and at some places, particularly in the gap at Tarbet, deep fissures can be seen high up on its southern slopes which mark the lines of incipient landslips. Stones dropped into some of these rents can be heard rattling a long way down into the mountain side, and some day, when perhaps there is an abnormal snow or rainfall, pieces of the loosened mountain side will move downwards and no doubt alarm the inhabitants by the exhibition of a geological phenomenon that happily is not now very common on a large scale in the district.

While this was probably something like the early history of the valley, the other tributaries of the pushful Clyde were not idle. It must be mentioned that the rocks at the turn of the estuary above Dunoon are soft Carboniferous or Old Red Sandstone strata much more easily eroded than the tough old Highland schists further north, and the high ground on the south side is made up of hard volcanic rocks, the continuation of the Campsie and Kilpatrick range. Between these two hard tracts the Clyde has dug its channel. When the first breach had been made into the old Forth valley between Holy Loch and Gourock, the head of the stream flowing east was diverted to the south, and very little water was left to feed the Forth from this source. The next part to be tapped was the water in the previously decapitated Gareloch valley, and there may have been a waterfall where it entered the Clyde near Greenock. As the process went on the whole of the upper reach of the ancient Forth became in time obsequent, and it did not take much further trouble for the Clyde to draw off the remainder of the old river as far east as Kilsyth, through the outlet at Gourock. The sedimentary rocks in that district are more or less easily eroded, and the deep breaches through the harder volcanic ridge of the Campsie, Kilpatrick, and Renfrew hills, had been already cut out by the older river. All this work, it must be remembered, was done at the time when the river beds were above the level of the gap at Whistlefield, at least 320 feet higher than at present, and the firths and lochs had no existence. The general subsidence of Scotland at the Glacial period finally submerged these old valleys and converted the deepest of them into arms of the sea.

If the ancient Clyde, on this hypothesis, entered the Forth by the col at Kelvinhead, which remains still about 160 feet above sea-level, it

follows that all the river basin to the west must have been then at a higher level than the col.[1] Supposing for the sake of argument we disregard the probable additional height of the whole ancient land surface above the sea and take the level of the Kelvinhead watershed when last occupied by the old river at 160 feet above ordnance datum. If now the river had a fall of say 4 feet per mile, which is a moderate gradient, the distance from Kelvinhead to Gourock being 33 miles, the whole fall would be 132 feet and the height of the valley at Gourock 292 feet above its present level. At this gradient the river bed would be at Whistlefield, which is 9 miles further on, 36 feet higher, or 328 feet above sea-level. The actual height happens to be 320 feet at that spot, and this helps to show roughly how much higher the bed of what is now the Clyde must have been at the time of which we are now speaking. No doubt the absolute height above the sea was far more than this, as the whole country must have been far above the present sea-level, but that does not affect the present argument.

If we were to fill up the Clyde at Dunoon by a dam only 200 feet high, and make a smaller barrier at Castle Semple Loch, the Clyde and all its tributaries would submerge the Glasgow district again and overflow into the Forth by way of the Kelvin valley.

The Loch Lomond valley appears to have a somewhat different history from that of Loch Long. It is, I believe, in the main an old consequent valley, and the Ben Lomond ridge marks part of an original water-parting between two tributaries of the Forth. The southern broad part of the loch, with its beautiful archipelago of low islands, is entirely excavated out of soft sandstone, and the great fault that forms the junction line between the metamorphic and sedimentary rocks runs across it in a NE. direction past the north side of Inchlonaig.

As already noted, the east side of Loch Lomond as far north as Tarbet trends nearly in a straight line, striking south-eastwards for the Strathblane gap in the Campsie plateau, and this seems to be the line of the old consequent river valley. Above Tarbet, however, the glen narrows and runs almost due northwards. At this slight bend the ancient mouth of Glen Croe comes in, and here it seems to me the original valley ended and split into two smaller glens. Glen Croe, whose history we have already considered, was the larger, and the smaller one ran straight northwards for about two miles, ending originally in a corrie below Inversnaid and Upper Inveruglas.

This may appear at first sight a curious conclusion, but it seems to be warranted by the following evidence :—

At Inversnaid, exactly opposite Upper Inveruglas, the Ben Lomond ridge, as we have seen, is notched by the deep gap of Glen Arklet, which runs through to Loch Arklet, and is at its highest point only 463 feet above sea-level. This is the only pass through to Loch Katrine, and is cut across a ridge of mountains more than 2000 feet in height. It is thus

[1] This is the height of the surface of the ground only, but the true rock bed of the col is less than this. Recent borings in the valley have proved that there is a covering of 60 feet of soil and drift over the rock a short distance west of Kelvinhead, and thus the height of the rockbed of the ancient channel may have been less than 100 feet here.

some 1600 feet deep, and lies exactly in the line of the Inveruglas Glen, which is also of great depth. Glen Arklet is manifestly the eastern continuation of that valley, and the two were connected at a time when the Loch Lomond river was 500 feet higher than at present. The panoramic sketch (Plate IV.) from the top of Ben Vorlich shows the Loch Katrine valley, Loch Arklet and Glen Arklet crossing the Ben Lomond ridge at Inversnaid.

The ancient outlet of Loch Sloy was thus in its lower reaches a straight valley about six miles long that apparently joined Strath Gartney on the site of what afterwards became Loch Katrine, or perhaps its waters overflowed into the valley of Loch Chon and Loch Ard and broke through the Menteith Hills at Aberfoyle in the Forth valley.

Now, if this be so, it is clear the Loch Lomond stream did a little stealing like its neighbour of Loch Long. The small tributary supposed to have run northwards from Tarbet seems to have followed the prevailing fashion, eaten its way north and tapped the eastward-flowing Arklet-Inveruglas Water, no doubt occupying a more elevated glen, as the Loch Long river was doing a few miles away. The Inveruglas stream was drawn off and a dry wind-gap left through the Ben Lomond ridge, which in course of time formed the bed of the obsequent little River Arklet well known to tourists at the falls of Inversnaid. The new dam of the Glasgow waterworks across the glen above Inversnaid will have the effect of sending the water eastwards into Loch Katrine, and changing the Arklet from an obsequent to a consequent river once more.

There still remains for explanation the northward extension of Loch Lomond, and here I admit the evidence is not very clear. It looks to me as if the Clyde by this time had drawn off the lower part of the Loch Lomond river, and there was thus a much greater fall towards the south than to the east. In this way the southward flowing tributaries of the Clyde would be eating their way backwards into the plateau much faster than the headwaters of the Forth. There is no clear evidence of a line of fault, but there may well have been a straight series of joints or a line of weakness at this place which produced two original glens in the line of the Loch Lomond valley, and the ancient Inveruglas Water may have been joined on the north by a large stream on this line opposite the very place where it was being tapped from the south. When the barrier was cut through, the northern tributary thus ran straight on down the line of the crack, which in time became greatly deepened and widened with the additional volume of the confluent waters from the high plateau to the north and west, and was finally still further excavated by glacier action to a depth of more than 600 feet below sea-level.

The river, whose headwaters thus probably at first ran from the Ben Ime and Loch Sloy plateau, eastwards towards the Trossachs, would form an important feeder to the great tributary of the Forth that originally excavated the glens of Loch Katrine or Loch Chon, which are now occupied by far smaller streams than their size seems to warrant.

The Douglas and Luss waters were, no doubt, branches of the

PLATE IV.—View eastward from Ben Vorlich (3092 ft.), showing Loch Lomond, Loch Katrine, Loch Arklet, and the obsequent Arklet valley at Inversnaid.

original Loch Lomond river. The Fruin and Finlas glens probably mark the sites of two branches of another considerable stream that ran south-eastwards through the gap at Alexandria, now occupied by the River Leven. All these points can best be followed by reference to the appended map of the old river system.

After all these depredations the south-western branch of the Forth shrank up and became obsequent from Kilsyth westwards, and the northern branch, above the confluence at Grangemouth, became henceforth the main trunk of the river.

The Forth crossed the volcanic ridge of the Campsies and Ochils at Stirling, having, no doubt, sought out its weakest place, where the rocks were not only dislocated by several great fractures, but the hard whinstone beds of the two ranges had thinned away at their outcrop to a narrow neck through which the river had no difficulty in selecting and clearing out a passage. Above Stirling the country is principally made up of Old Red and Carboniferous Sandstone beds, and the degradation of these was regulated by the rate at which the river was able to deepen its gorge in the harder whinstone barrier between Stirling Castle and the Abbey Craig, at the foot of the Ochils.

The lowering of the Loch Lomond valley went on at the same time, and in the gap at Balfron there are traces of a channel between that old branch of the Forth and the present river, before the Clyde had completely won in the race of degradation, deepened its bed, and sucked away the last vestiges of the original tributary. The Teith, flowing from Loch Katrine and Loch Lubnaig, is an old tributary from the north, but the Allan Water, like the Devon, is apparently a more modern and partly an obsequent stream, belonging to a later period. Both the Devon and the Allan enter in the wrong direction and cannot be considered as part of the original river system.

It is noteworthy that the Forth below Stirling has no large tributaries from the north. On the south, however, besides the Carron, three normal rivers enter the Firth, and run north-eastwards in old valleys nearly parallel to the Kelvin-Bonny glen. The River Avon, on the west boundary of Linlithgowshire, although it has now a sharp kink to the west at Linlithgow Bridge, no doubt once continued its north-eastern course to the main river below Blackness. The ancient valley was deeply trenched across the hard volcanic ridge, which must have once formed a single range extending continuously through West Lothian from the site of Bathgate to what is now Bo'ness on the shore of the estuary. The hollow in which the romantic old palace and loch nestle in picturesque serenity was part of the original Avon valley before the Ice Age, the last three miles of the present glen above Inveravon being a comparatively recent excavation.

The Almond, which bounds the county on the east, is also apparently another old consequent stream. It too has slightly changed its course at the mouth. The old glen ran under Dalmeny House, and the gorge between Cramond and Craigiehall was excavated after the Ice Age. At that time the whole country was first swept by a great glacier or continental ice sheet, and when the ice melted the land was

left so deeply buried under drift and clay that the rivers were often unable to recognise their old valleys, and had to start afresh to cut out new beds through the solid rock at the places where the ancient tracks had been lost and could not be recovered. The Almond, and its principal tributary the Breich, run for twenty-two miles in an almost perfectly straight course towards the north-east. The original Almond valley may have been continued at an early stage south-westwards across the line of the Clyde near Wishaw and Shotts to Strathavon, and been decapitated like the higher tributaries of the Forth, but that part of the Almond watershed is over 700 feet above sea-level, and the traces of the ancient valley system are somewhat faint in this district.

The Water of Leith and the North Esk in Midlothian both flow in the same general direction, one on each side of the Pentland ridge.

Those rivers of the Lothians have neither robbed their neighbours nor been much disturbed themselves in the course of their comparatively even history.[1] The rainfall being here much lighter than in the west, and the country flatter, their erosive power has been less than that of the higher tributaries of the Forth, and there has thus been little of eventful episode to record in their career.

But the Clyde did not rest content with robbing the Forth of so much territory. It worked its way as a subsequent river south-eastwards by Lanark, and appears to have ended by also invading the Tweed basin and drawing off some of the headwaters of that old consequent river at Biggar. But this is a question which does not concern the present investigation. The reason why the western river was able to wear down its valleys faster than the eastern streams is no doubt that the fall was greater to the west, and the rainfall was also much heavier next the Atlantic seaboard than elsewhere. The land surface was a vast sloping plateau culminating in high mountains with a steep fall towards the Atlantic Ocean, and a long gentle inclination eastwards towards the mainland of Europe, of which Scotland was then but the north-western corner.

## III.—The Buried Channels of the Forth Valley.

The next chapter in this fluviatile chronicle relates to events of a far later period, when the existing river-system was well established. The land, as we shall soon be able to prove, still stood at a higher level in relation to the sea than it does in our time, but the rivers had deepened their valleys more than 500 feet since the events that have just been discussed. As there were no lakes to act as regulators and filters to the streams, the rain, when it fell, rushed down the glens in angry turbid torrents and hastened the work of valley erosion.

The evidence for the original valley-system described in last chapter is based on observation of the superficial and orographical features of

[1] In Mr. J. Cossar's interesting paper on the Edinburgh district in the *Scot. Geog. Mag.* for 1911 at p. 599, a good example is given of a small depredation of the South Esk, which at Borthwick has captured two streams originally belonging to the river Tyne.

the country, that any one can study with good maps and eyes for the physiognomy of the landscape. But now we have to deal with a different kind of evidence altogether, evidence far more difficult and costly to obtain, but once acquired, perfectly sure and unimpeachable.

In some parts of the Forth and Clyde area that have been referred to as made up of soft carboniferous rocks, large quantities of coal and ironstone have been mined, and discovered by boring during the past century. While the pursuit of mineral wealth was the object of the boring, incidentally a great deal of important scientific knowledge has at the same time accumulated, relating to the nature and depth of the superficial soil-covering of the land in these districts. Many hundreds, and even thousands of bores and shafts have been sunk to the rock, and by collecting and examining the records of these—a most laborious piece of work—geologists have been able to prove that both in the Forth and Clyde basins there is a system of buried river channels far below the present surface under or near the existing rivers and their tributaries. These are all filled up, and so deeply buried under beds of clay, sand, and detritus that, but for the operations of the mineral explorer, their presence and depth would never have been discovered or perhaps even suspected.

It is interesting here to note that in the Niagara district also a great deal of boring for oil and gas has been going on in recent years, and Dr. J. W. W. Spencer has, by examining and collating the records of the drillings, been able in the same way to discover and trace out the ancient buried channel of the river which, it appears, once ran by quite a different course from Lake Erie to Ontario.

No doubt the phenomenon is not an isolated one, and buried channels exist at many other places in this country under the principal rivers and estuaries, but where there is no valuable mineral to search for it is not likely that much boring will be undertaken for purely scientific purposes. A bore 300 feet deep through loose materials is a difficult operation, costing perhaps a pound a foot; and the expense has been so great that it is to be regretted a good many bores that had been begun have been given up, where the "surface" became very thick, at places where it would be of great scientific interest to find out the exact depth from the ground level to the solid rock.

The existence of buried river channels in Scotland seems to have been first discovered in 1869, when Dr. James Croll described in the *Transactions of the Edinburgh Geological Society* the results of an examination by Mr. James Bennie and himself of some two hundred and fifty bores made in the valleys of the Kelvin and Bonny rivers on both sides of the water-parting at Kelvinhead. They traced the course of two gorges below the glacial drift filling the old gap, and running for most of the way along the lines of the existing streams. The eastern channel entered the sea at Grangemouth at a depth of 260 feet below mean sea-level, and the western in the Kelvin valley was found to be 306 feet below the surface of the ground at Duntocher, near the Clyde at Old Kilpatrick. The buried channels of the Glasgow district have been lately investigated in much greater detail by the Geological Survey, and

in the memoir published in 1911 a contoured map is given by Mr. Hinxman and Mr. Carruthers showing the pre-glacial topography of the valley very clearly.

Since Dr. Croll's time a great deal of mineral exploration of various kinds has been carried on, and in the Forth valley I have collected many fresh data and done some boring on my own account, all of which has helped to throw fresh light on the old river system as it existed both immediately before and after the Great Ice Age.

*The Almond.*—The Almond river, which now joins the sea at Cramond, had an older channel in pre-glacial times under Dalmeny House where the Dolphinton Burn now enters the sea. In the numerous borings for oil shale in that locality the course of the buried gorge has been accurately traced for about nine miles to the south-west. The Almond runs at places through glacial drift on the line of its original channel, but at a higher level, and at others it flows along a gorge more recently excavated in the rock. The old river was a steep one, no doubt, with numerous falls. Between Carlowrie and Midcalder the gradient was very high, about 31 feet per mile, and if this gradient was uniform the river must have entered what is now the estuary about 200 feet below the present sea-level. Carlowrie Haugh as seen from the Almond viaduct on the Edinburgh and Glasgow Railway is a comparatively tame little strath north of Ratho station, between low hills of whinstone, but at that time it was a picturesque glen more than 200 feet deep, and the half-buried crags of Dolphinton and Dundas were then high and prominent objects in the landscape.[1]

*The Avon.*—The River Avon has for the most part cleared out its pre-glacial valley, but, as already mentioned, there can be little doubt its original course to the Forth lay in the direct line of its upper valley west of Linlithgow. The deep hollow, now the bed of Linlithgow Loch, between the volcanic range of Cockle Roy and Bonnytoun Hill is, no doubt, part of the ancient Avon valley which, as has been proved by borings, was continued north-eastwards in a straight line and reached the main river on the east side of what is now the low basalt promontory of Blackness, but was then a conspicuous crag in the Forth valley. During the Ice Age the Avon valley became blocked up with drift, which is at places more than 100 feet deep, and the part east of Linlithgow was, when the great glacier retired, so obliterated, that the river found it easier to make a tack to the west and double round across the neck of soft rock west of Bonnytoun Hill, escaping by a shorter and steeper north-west passage to the Forth at Inveravon. The subsequent channel thus produced was in time deepened into a gorge which the river has occupied ever since. The Avon is a smaller stream than the Almond, and I have not yet found any traces of a very deep buried gorge along its course such as exists in the latter valley.

*The Carron.*—The Carron is a much more important stream than the Avon, and although, as explained above, it now only represents a

[1] See the author's paper on the "Buried Channel of the Almond," *Trans. Geol. Soc. Edin.*, 1903, p. 194.

fragment of the ancient river, it has, with its main tributary, the Bonny Water, been able in pre-glacial times to erode a deep and well-marked gorge, especially in the lower part of its course between Camelon and the sea at Grangemouth. I have gone over most of the evidence collected by Mr. Bennie and Dr. Croll, which has been supplemented by more recent mineral explorations, but have not found much to add to their results. Quite recently the Carron Company's workings in the Main and Upper and Lower Coxrod coals at Carronshore have encountered the buried gorge (Fig. 8). In a bore near the present river at Carronbank, about 430 yards north-west of Dalderse Mill Farm, the depth to the rock was 285 feet, and the channel was filled chiefly with sand and loose materials. The surface of the ground is here about 22 feet above mean sea-level, so that the bed of the buried valley is 263 feet below Ordnance Datum at this spot. Neighbouring bores have proved the depth of surface deposits to be between 100 and 200 feet on either side, so that the deep channel forms a hollow 50 or 60

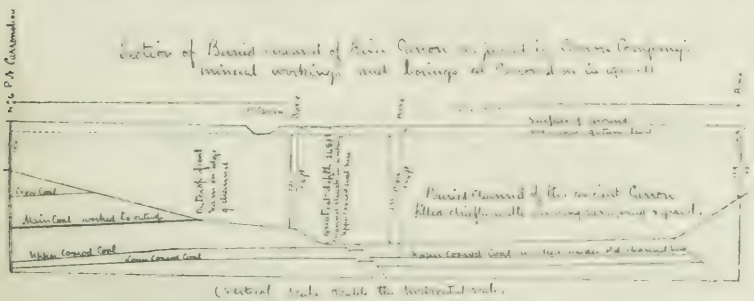


FIG. 8.

feet below the level of the deepest part of the neighbouring rock surface. The section given by Dr. Croll at Towncroft near Grangemouth is three-quarters of a mile further down the river, where the depth was found in two adjoining bores to be 42 and 45½ fathoms, or 252 and 273 feet respectively. In the adjoining Main coal workings of the Grangemouth Colliery, still further east, the coal was cut off to the south at a depth of 43 fathoms by a wall of clay running eastwards towards the mouth of the present river. From this point to Carron the course of the buried gorge has been accurately traced for three miles. It is, as I have already noted, a very difficult and costly business to bore a hole 40 or 50 fathoms down into running sand, clay, and loose materials, and some of the bores did not succeed in reaching the very bottom of the channel. This is no doubt unfortunate, geologically, but it must have been deeper downstream than at Carron, and the Towncroft bores probably did not strike the very lowest point. In No. 6 pit workings at Carronhall Colliery the Main and the Upper and Lower Coxrod coals were cut off by the clay down to a depth of about 248 feet, but a level mine was successfully driven at a depth of 271 feet right under the trough, which proves conclusively that its deepest point at Carron goes

down to 248 feet at least, but not so deep as 271 feet. As the coast at Grangemouth is three miles further down stream, and a river able to excavate such a gorge must have been fairly swift and steep, it follows that the depth at the present coastline must be at least 280 and perhaps 290 feet below the surface. If, like the old Almond valley, it had a fall of as much as 30 feet per mile, or even only 10 feet, the depth would then be considerably over 300 feet. This point is important in connection with what follows later.

The old glen seems to have been from 400 to 500 yards wide at this place, but as most of the boring and nearly all the mining has been carried on along the north or left bank there is no very decided evidence as to the exact width of the deepest part of the trough. It apparently was not much more than 500 yards at any place, and was certainly less at some spots. Superficial deposits of the Carse near Grangemouth cover the rock surface to a depth of more than 100 feet, showing how great has been the erosion of the old Forth valley before the great submergence at the Glacial Period. But in that old rocky land surface there had been scooped out glens 100 or even over 200 feet deep, and no doubt there were numerous side gullies and branches the courses of which we may never be able to trace.

*River Devon.*—The last of the old tributaries of the Forth of whose buried course I have been able to obtain a record, is the Devon between Tillicoultry and the Abbey Craig at Stirling.

The Devon is in some ways the most remarkable tributary of the Forth. It runs westwards for the last twelve miles of its course, against the flow of the main river, and seems, according to the code of common fluviatile law, to have no legal right to be in that position. The Devon, from the Crook westward, with its abnormal course, is a much younger tributary of the Forth than the others we have considered, and in this respect it shares the character of the Allan Water. Both are upstarts and robbers of other rivers' territory, and do not belong to any part of the old consequent river system of the Forth.

The Devon has two distinct sections. The higher reach of the river issues from the deep trench across the centre of the Ochils, the southern end of which is called Glen Devon, and the northern Glen Eagles. Now Glen Eagles is the only deep pass across the range, and is occupied by a comparatively small stream running past Auchterarder into the Tay. But to go back to the original river system this gap, whose present water-parting is about 750 feet in height, probably marks the course of a consequent river flowing first south-eastwards from the Glen Artney Forest, and then eastwards by Loch Leven to the lower part of the Forth valley, or more likely north-eastwards from Loch Leven along the valley of the Eden between the Forth and Tay, at a time when all the land behind the Ochils was more than 750 feet above sea-level.

The volcanic ridge of the Ochils was a hard plank to saw, and the Forth valley being now worn deeper at the Stirling gap than the higher-lying part of the Devon north of Glen Eagles, the tributary of the Allan Water succeeded in eating its way back and drawing off to the south-west some of the headwaters of the old Devon. The Tay was also at

work, and its tributary stream the Ruthven Water also invaded the territory from Auchterarder on the north. Gradually Glen Eagles was thus dried up and became the bed of an obsequent stream running north into the Ruthven Water and the Tay. The other end of the old Devon Pass was attacked in the same manner by a tributary of the Forth eating its way back along the great fault-line skirting the southern face of the Ochils. In time the river was tapped by this industrious newcomer at the Crook of Devon and the water diverted into the south-western channel, now the lower Devon valley, so as to dry up the headwaters of the ancient Eden.

The Great Ice Age, it must be explained, was not a single continuous cold period, but was subdivided by one or more so-called *interglacial* periods with a more or less mild climate. This part of the Devon valley may have been excavated during one of these intervals after the greatest cold had ceased. The reason for this supposition is the fact that the buried gorge is filled, not with the hard boulder clay produced under the great ice sheet of the coldest period, but with gravel and the red glacial clay deposited in sea water after the large glaciers had retired to the mountains, and at a time when the land was submerged and the sea stood at about 100 feet above its present level.

The above seems to me the most feasible explanation of the peculiar course of the river, but its history by no means ends with this episode. We have now to do with the later history of the Devon after the twelve-mile reach below the Crook had been permanently established. It is indeed difficult to see why, before the land was so much denuded down, the river should not have found its way directly south-eastwards past Saline to the Forth at Torry Bay. The reason probably is that the line of least resistance was along the great fault which skirts the Ochils and runs obliquely across the Forth at Stirling. The Forth had found a weak place to break through at Stirling, where the great faults that traverse the country had split the whinstone plateau with a line of cleavage the river was not slow to take advantage of. A small tributary no doubt began to run off the slope east of the Abbey Craig into the Forth, and worked its way upwards and eastwards along the line of the Ochil fault. As the Forth was deepened and the soft carboniferous strata were gradually worn away, the harder volcanic rocks of the Ochil range became more prominent, and the easiest path for the water to follow was along the junction of the hard and soft rocks. Once the little stream had started it kept its course, and as the main valley grew deeper, the tributary fed by streams from the high ground to the north was correspondingly deepened. After it had eaten its way back and tapped the old Devon, it would, like other predatory streams, be greatly enlarged and strengthened with the acquisition of so much more water.

From Tillicoultry to the base of the Abbey Craig, a distance of six miles, the river runs in a straight course along an alluvial flat at the foot of the abrupt face of the Ochils, and further out the ground rises slightly and the rocks of the coal measures appear on the surface in a low ridge extending continuously down to the Forth. A great deal of mining and boring has been done in this alluvial strip and along the

river banks, and many bores have disclosed a deep and narrow gorge all the way from Tillicoultry to Blair Mains near Blairlogie. So far as I have been able to discover, no boring has been done to the east of Tillicoultry, but as the river is on alluvium all the way to Dollar, this buried gorge no doubt runs up past Dollar to the place where the river can still be seen at work extending the chasm, but at a higher level, in the well-known falls of the Cauldron Linn and the Rumbling Bridge.

The buried gorge which we shall now consider was, I believe, first proved by boring in the year 1826 on Alva estate, west of Tillicoultry. In that year one bore near the river found the depth to the rock to be 241 feet, and in several others more than 150 feet. In 1873 a neighbouring bore apparently nearer the centre of the channel went down 318 feet before reaching rock. In 1887 a third deep bore was made close to the river at Kersiepow, about half a mile further up, which proved the depth to be no less than 336 feet. A fourth bore made in 1872, close to the road at the public park on the west side of Tillicoultry, exactly a mile further up than the Kersiepow bore, struck the rock at 342 feet. This bore is on the 50-feet contour line at the foot of the hill slope, and shows that close to the Ochils the old gorge has been excavated to a depth of almost 300 feet below the present sea-level.

This is the highest bore in the old valley that I have heard of, but at Glenochil Distillery, near Menstrie, a mile and a half below Alva, another bore was made for water which went down 330 feet before reaching the rock. The last of these interesting borings on the line of the old gorge was made so recently as October 1910. It was made at Blairmains, on Powis estate, two miles west of Glenochil, and proved the depth to the rock to be 305 feet. The ground is there about 40 feet above sea-level.

The old Devon thus occupied the deepest buried gorge that has been disclosed beneath the tributaries of the Forth, showing it to have been a swift river with great erosive power. The breadth of the channel at Alva was less than half a mile, and at Craigmill, at the east side of the Abbey Craig, seven miles below Tillicoultry, where it joined the Forth, it was not more than 600 yards across. The hard basaltic escarpment of the Abbey Craig projecting from the Ochil ridge deflected the last mile of the otherwise straight channel, causing it to bend southwards to the confluence with the Forth.

*River Forth.*—The course of the buried channel is shown on the map (Plate V.). The figures are the depths in feet of different bores through the surface deposits to the solid rock. The panorama (Plate VI. Fig. 9), is intended to show what may have been the appearance of the Forth valley at Stirling as seen from the Abbey Craig at that time, and Fig. 10 on the same plate is a sketch from the same spot of the valley after being filled up to its present level before the human period.

There has recently been a great deal of boring for coal in the Carse of the Forth between Stirling and Alloa, and I am indebted to the various land and coal owners for kindly allowing me to use the information they

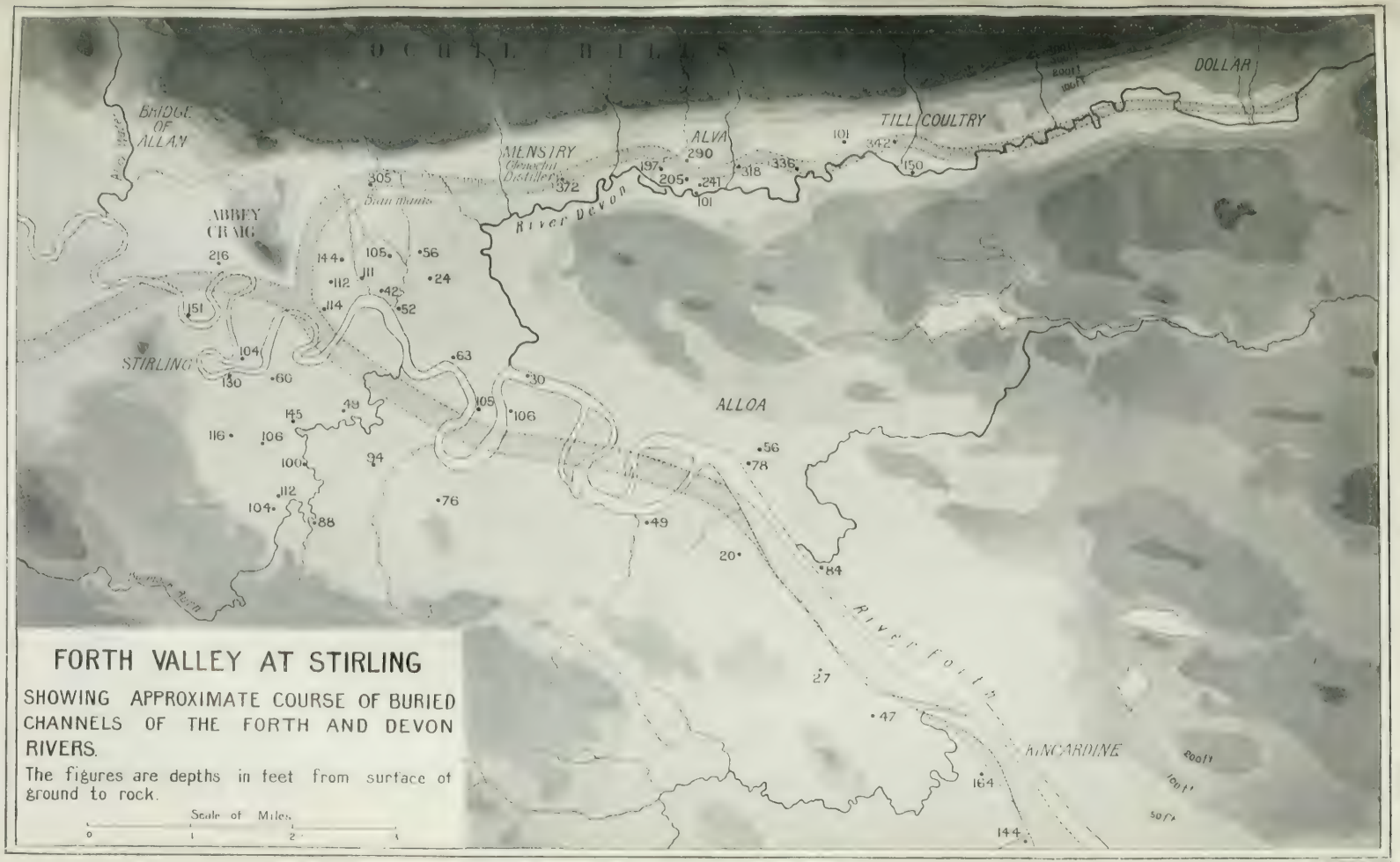


PLATE V.—Buried Channels of the Forth and Devon.

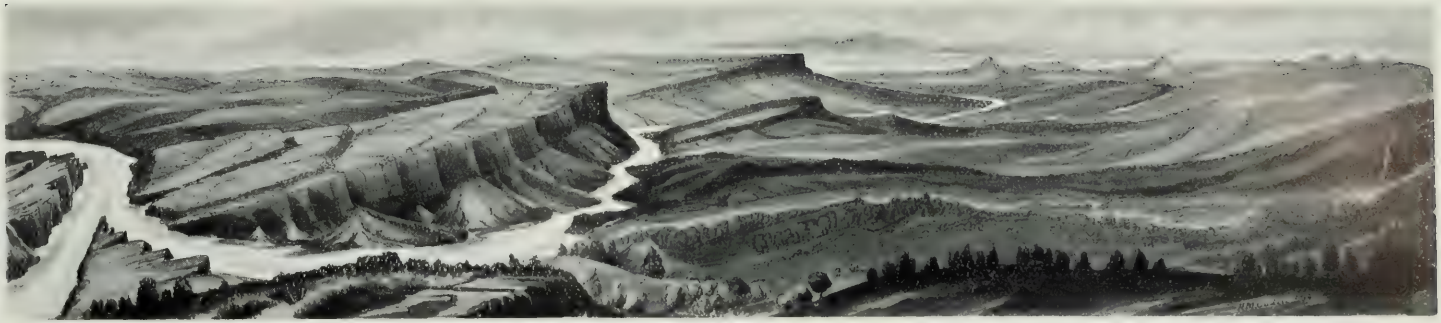

FIG. 9.—Confluence of the Forth and Devon before the deep channels were buried.

FIG. 10.—The same place after the old glens were filled up.

PLATE VI.—Panoramas from the Abbey Craig at Stirling at different periods in the history of the Forth.

obtained as to the nature and depth of the superficial deposits in that part of the Forth valley.

At present we are not considering the kind of deposits found in these borings, but only the evidence they give of the depth and position of the buried river channel. It would have been a matter of great scientific interest if a single bore journal in the Carse of Stirling had disclosed 300 feet or more of "surface," but out of a large number I have collected not one bore seems to have reached the rock head at such a depth. Several of them, owing to the great difficulty in penetrating so great a thickness of loose material, after going down a considerable way, stopped and never reached the rock at all. So far as I have been able to ascertain, the deepest surface bore in this part of the Carse was at Causewayhead, near the river north of Stirling, where the alluvial deposits were found to be 216 feet deep. At the river south of Cambuskenneth Abbey, the rock was reached in two bores at 103 and 130 feet respectively, and a continuous series of bores extending to Drypow, 2 miles to the south-east, show the depth of surface to be between 60 and 145 feet. From these it is clear the old gorge must run further north than the line from Cambuskenneth to Drypow. But there has also been boring north of this line, and it appears the rock is only 10 fathoms or less below the Carse between the mouth of the Devon at Cambus, and the mouth of the Powis Burn at Manor Castle. Indeed, in boring for a railway bridge opposite Cambus, the rock was found only 30 feet under the bed of the Forth. Two bores were however made south of this line, one at the Haugh of Blackgrange, and the other at Bandreath, in which the depth to the rock had dropped to 105 feet, and these seem to be near or on the north side of the gorge we are in search of. No borings have been made along a belt of ground three quarters of a mile wide and two miles long, on the centre of which lies the old Polmaise House and policies at the east end, and the Haugh of West Grange at the west. If there is a deep gorge here it must occupy that position. As we follow it down the valley it must run through Tullibody Inch, Alloa Inch, and South Alloa; but it clears Alloa Harbour, as the rock is not deep on the north side of that part of the river. Borings to the south of South Alloa disclose only 75 feet of surface, and all the way down to Dunmore the rock is found at very shallow depths. On the north side of Clackmannan Pow, opposite Dunmore, it is only 84 feet down, and it is clear that the ancient gorge, if it exists at all, must exactly correspond with the present river-course between Alloa and Kincardine. Coal workings have been carried on along both sides, but none have gone under the actual river bed, which at Dunmore is about quarter of a mile broad. Kincardine Ferry is 4 miles below Alloa, and the rock is quite shallow on the Kincardine side, but on the south bank at Higgin's Neuk, in a boring made by the North British Railway for a proposed tunnel about 1890, the depth of surface was found to be 164 feet. This no doubt indicates the south side of the gorge. The distance from high-water mark at Higgin's Neuk to the opposite bank at Kincardine is half a mile. Below Kincardine the river-bed widens into the regular estuary. At Powfoulis, three

quarters of a mile below the ferry, a boring made by the Carron Company in 1904, 600 feet from the river, proved the depth to the rock to be 144 feet, and another bore, close to Powfoulis House and 2000 feet back from the bank, passed through 164 feet of surface before touching rock. The depth to the rock is less than this in the parts of the Carse further back from the river, so that there is no possibility of the deep gorge being situated anywhere except under the existing channel at this place.

At Grangemouth the Forth is joined by the Carron, and if we produce the line of the latter we find it runs across the Firth towards Culross and Torry Bay. In a paper read before the Edinburgh Geological Society in 1881 I gave reasons for supposing that Torry Bay is on the site of another part of the buried river channel. The bay forms the arc of a circle, with a chord of three miles, stretching through Preston Island from Culross to Crombie Point. The coast recedes three-quarters of a mile back from this line, in the centre of the bay. In the centre of the bay, which is entirely dry at low tide, there is a reef of sandstone rocks, known as Craigmore, extending south-westwards for three-quarters of a mile from Preston Island to the edge of the foreshore at low-water mark. This is only an island at high tide, when the foreshore and the rest of the reef is covered. A belt of mud, three-quarters of a mile or more in width, sweeps round the bay between the island and the shore, the west end of which is generally submerged under a tongue of water known to seamen as The Strath. Now it is clear there must be some geological reason for this. The shore of the bay is backed by low cliffs, and the sea does not eat away its coastline at this sheltered place. If it did, the sandstone island—the only island not of whinstone in the Firth—would have been the first part to be washed away. The only explanation appears to be that at one stage of the history of the valley, before erosion had gone so far, Preston Island belonged to West Lothian and not to the Kingdom of Fife, and during the Glacial Period the river course was changed by the glacier, that like a good engineer straightened as well as deepened this part of the valley, and wiped out the old sinuosities of its track.

The evidence is not, however, entirely circumstantial. Coal-mining was carried on by Sir Robert Preston of Valleyfield, who a little more than a century ago sunk three pits on the island, and lost a great deal of money in them, partly, perhaps, because he did not know about the old river channel that separated the island from the rest of his domain. The deepest shaft was sunk to forty-six fathoms, and a water-level was driven 270 yards in a NNE. direction from the bottom of it towards Torry. At the end of this level the clay seems to have been reached at 276 feet below the surface, when the workings were abandoned in 1811. My father, who told me of the deep trough that Sir Robert had found, did some boring himself in the bay in 1839, and found the depth to the rock at the end of the old pier at Torry to be sixty-three feet. In another bore made more recently in the bay, but 870 yards further west, the depth was 120 feet, and in a third boring 200 yards still further west, and probably past the centre of the bend, the depth of surface was sixty-four and a half feet. The ancient Moat Pit of Sir George Bruce in the

sea opposite Culross, to which King James VI. made his famous visit, belonged to quite a different colliery from that at Preston Island. The Culross Moat, which was connected by a subterranean passage with the shore, was sunk in the rock under the foreshore, some distance to the north of the old gorge. It was destroyed by a great storm in 1625, and the remains of the structure can still be seen in a heap of stones on the mud. There was, however, another old pit on the foreshore nearer Preston Island, called the Valleyfield Moat, the ruins of which are also faintly discernible. The position of the Valleyfield Moat enables us to trace out tolerably accurately the course of the buried channel lying between it and the Craigmore reef. The Moat lay 1100 yards NW. from the island, and the breadth of the deep channel between is probably not much more than 500 or 600 yards.

Why, it may be asked, was the old river originally deflected northwards towards Culross? The reason probably is that the hard ridge of the Bathgate and Bonnytoun hills, made up of volcanic rock interbedded with the coal-bearing strata, extended much further north than the promontory of Bo'ness before the Glacial Period, and formed an obstacle in the path of the river, which at all other places between Stirling and Queensferry had only soft strata to work upon. The whinstone beds, which originally came from a volcano to the west of Linlithgow, thin out towards the north, and the river found an easier path round the end than across the back of the volcanic ridge. The influx of the Carron at Grangemouth may also have helped to push the stream towards the north at the confluence.

At Crombie Point, on the east side of Torry Bay, where coal was being worked in the eighteenth century, before the colliers received their liberty, tradition records a sad accident that has some bearing on the present investigation. The submarine workings suddenly tapped a bed of running sand that burst in and spread death and destruction through the mine. The late Mr. William Hurst, formerly locomotive superintendent to the North British Railway, who was a native of the district, writing in 1881, told me that sixty years previously an old collier in Fordell, named William Ramsay, had related to him how his grandfather, who was then a slave, had lost his life in the disaster. No doubt the miners suddenly struck the buried channel at an unexpected depth.

From Crombie Point eastwards it is not possible to trace the gorge with much accuracy. Lines of borings were carried across the estuary at three places in 1864 by the promoters of the first Forth Bridge scheme of Mr. (afterwards Sir) Thomas Bouch, the engineer of the first unfortunate Tay Bridge. It was found that there was everywhere an enormous depth of soft silt, even where the water was deepest. The late Mr. Thomas Wyllie, the contractor, who carried out the borings from the side of a steamer, told me that one day he pushed the boring rods right down into the mud without any trouble to a depth of twenty-seven fathoms. Mr. D. Westland, C.E., has kindly lent me the Parliamentary plans, notes of boring operations, and evidence given by the promoters, from which it appears that in May 1864 two bores went

down 166 feet from low-tide level without getting to the bottom of the silt. In 1865 another set of borings was made between Blackness and Charlestown, and one of these, only about 500 yards from the coast at Charlestown, was sunk to a depth of 231 feet below low-water level without reaching the bottom of the mud. Boring through such materials was a marvellously quick operation. The deep bore just referred to, including the time required to put in the tubes, was begun in the dead of winter on 20th January 1865 at 9.30 A.M. and by 10.30 P.M. the work was completed and the rods drawn up.

More recently a great deal of boring has been carried out at Rosyth, and a few bores have been made at Crombie Point about which Colonel Exham, R.E.,[1] has kindly given me information. These were not so deep as the old borings of 1865, but they tell the same tale. Outside low-water line the rock slopes steeply down under an immense deposit of soft silt, and it is only near the shore that the hard boulder-clay is to be found resting on the solid rock. The ancient river channel was outside the Du Craig, and the abyss between the south side of Binar rock and the bridge, where the water alone is 41 fathoms deep, no doubt marks this part of its course. The south face of the Du Craig is a steep precipice plunging down to an unknown depth under mud, covering thick beds of red clay and other glacial deposits, but between the Du Craig and the north shore the rock surface is not very far down, and there is a good foundation for naval works.

When the Forth Bridge was begun I had many opportunities of visiting the works, including the deep foundations of the south cantilever which are built on the hard boulder-clay that extends most of the way from Inchgarvie to the south shore. The depth half way between Inch Garvie and the south shore, where the water is 37 feet deep, was found in the borings for Mr. Bouch's proposed bridge in 1870 to be 102 feet from high-water level to the top of the till which overlies the rock. No doubt the deep gorge of the old river was on the north side of Inch Garvie where, but for the water that fills it, the chasm is still open to a depth of nearly 40 fathoms.

That some parts of the old bed of the Forth are far deeper than 300 feet there is, however, direct evidence. In the submarine coal workings at Bridgeness and Bo'ness, on the writer's estate of Grange, directly opposite Crombie and Preston Island, the seams have been worked northwards to the outcrop where they have been abruptly cut off by a steep barrier of boulder clay, full of ice-worn stones and boulders of various kinds of travelled rock foreign to the district. The edge of this barrier has been followed westwards in the workings for more than a mile, and the greatest depth at which it has been encountered opposite Bridgeness is no less than 570 feet below high tide level at a distance of nearly half a mile from low-water line. But so far there is no evidence that this is the deepest part of the buried valley, as the rock abuts against a more or less steep face of clay the bottom of which has apparently not yet been reached.

[1] The engineer in charge of the works up till the end of 1911.

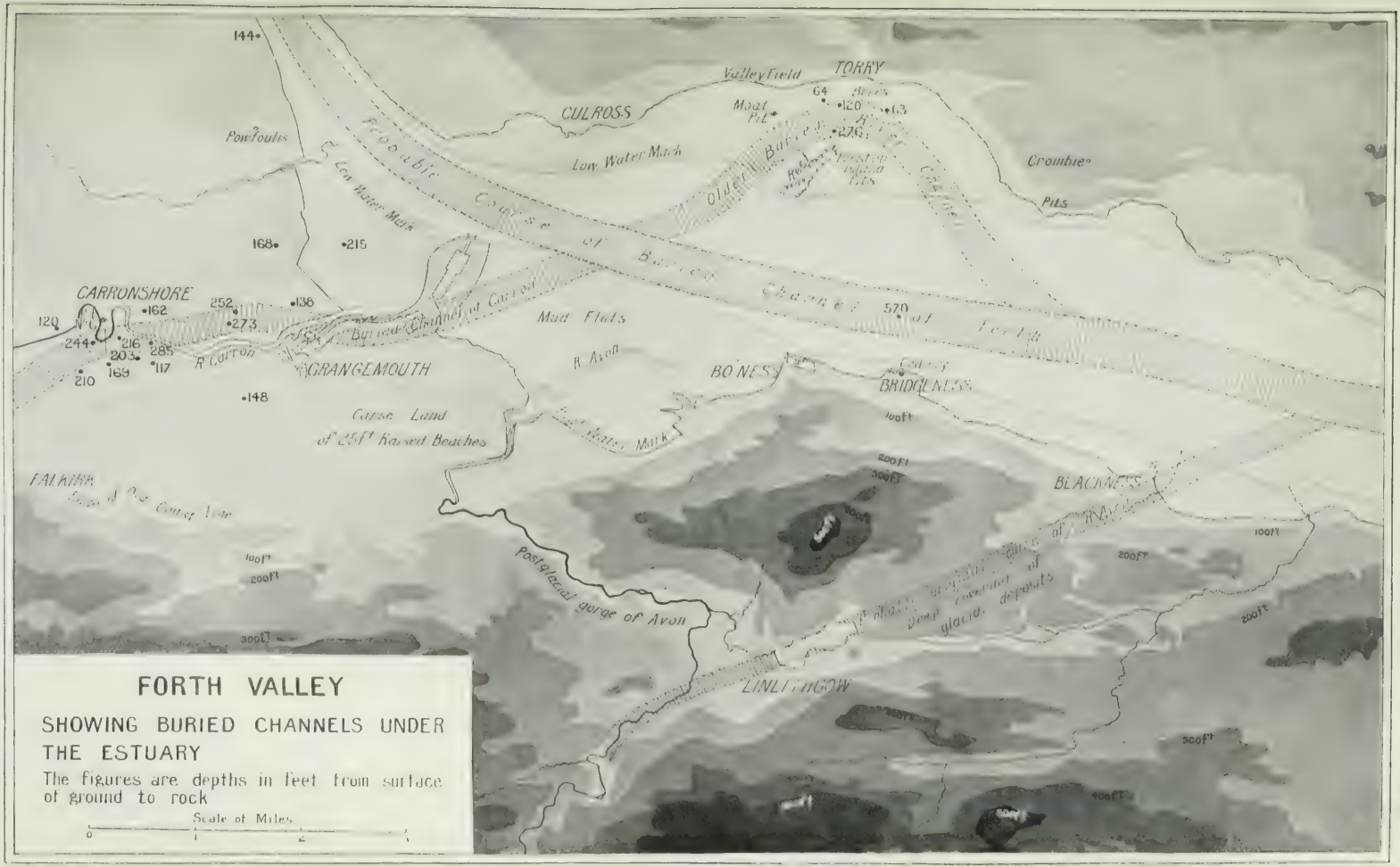


PLATE VII.—Buried Channels under the estuary of the Forth.

# FORTH VALLEY KEY MAP

PLATE VIII.

It is, however, doubtful to me whether this is to be regarded as the original preglacial river bed, or a later rock basin deepened by glaciers like the western lochs, which are sometimes more than 600 feet in depth. If the original Forth ran round Torry Bay, as I have suggested, it could hardly have occupied another and deeper channel at Bo'ness at the same period. I am rather inclined to think that Torry Bay marks the site of an original loop in a more or less serpentine channel, which, according to the common habit of rivers, was subsequently cut off by the river straightening its course. The large glacier of the Ice Age under which the hard boulder clay was manufactured moved in a straight and even course, and no doubt scooped out the underlying soft rocks to a considerable depth and produced a true rock basin extending for several miles like a straight gutter along the centre of the valley. In the workings of the Grangemouth Colliery five miles further west the boulder clay under the foreshore has also been approached from below, but at a depth of only 215 feet, but this is at a greater distance from the centre of the channel than the Bridgeness workings. Further mining developments are necessary to solve the problem completely, but, as has been already mentioned, the undoubted buried river gorge of the Devon is entirely filled with fine red silt, mud and gravel, apparently all deposited by water, and not with hard boulder clay firmly compacted by the pressure of huge glaciers. The other buried river channels all contain more or less sand and gravel of fluviatile origin as well as local beds of true boulder clay.

But what we have been considering is mainly the action of running water and the origin of the old river system, and not the effect of the Ice Age on the Forth district. That episode is too important to be adequately dealt with at the end of this chapter, and all that I have done is to make a few passing references to it in connection with the other points relevant to the discussion.

This discussion of the buried channels is of interest for two reasons, one of them scientific and the other economic. From the first standpoint it is clear that since the river occupied the deep channel a great submergence has taken place. We saw that in the Devon valley the old river bed reached down to 300 feet below sea-level, and the Carron was probably also as deep at the mouth. But the changes in level were regional and not confined to one part of the country. In the Clyde basin Mr. Bennie found the buried channel of the Kelvin at Duntocher to be also about 300 feet deep, which shows that the amount of submergence of Scotland was at least 300 feet. No doubt there is also a buried channel under the bed of the Tay to which reference will again be made.

But the Devon, the Carron, and the Kelvin were only tributaries of much larger rivers which carried all the sediment away to a great distance and kept the side valleys quite clear. Between Stirling and Kincardine we saw that the main river must have had only a narrow gorge, the maximum depth of which has not yet been fathomed by the borer's tool. But if the channel had a small width it must have had steep sides and a great depth to vent a large volume of water. The

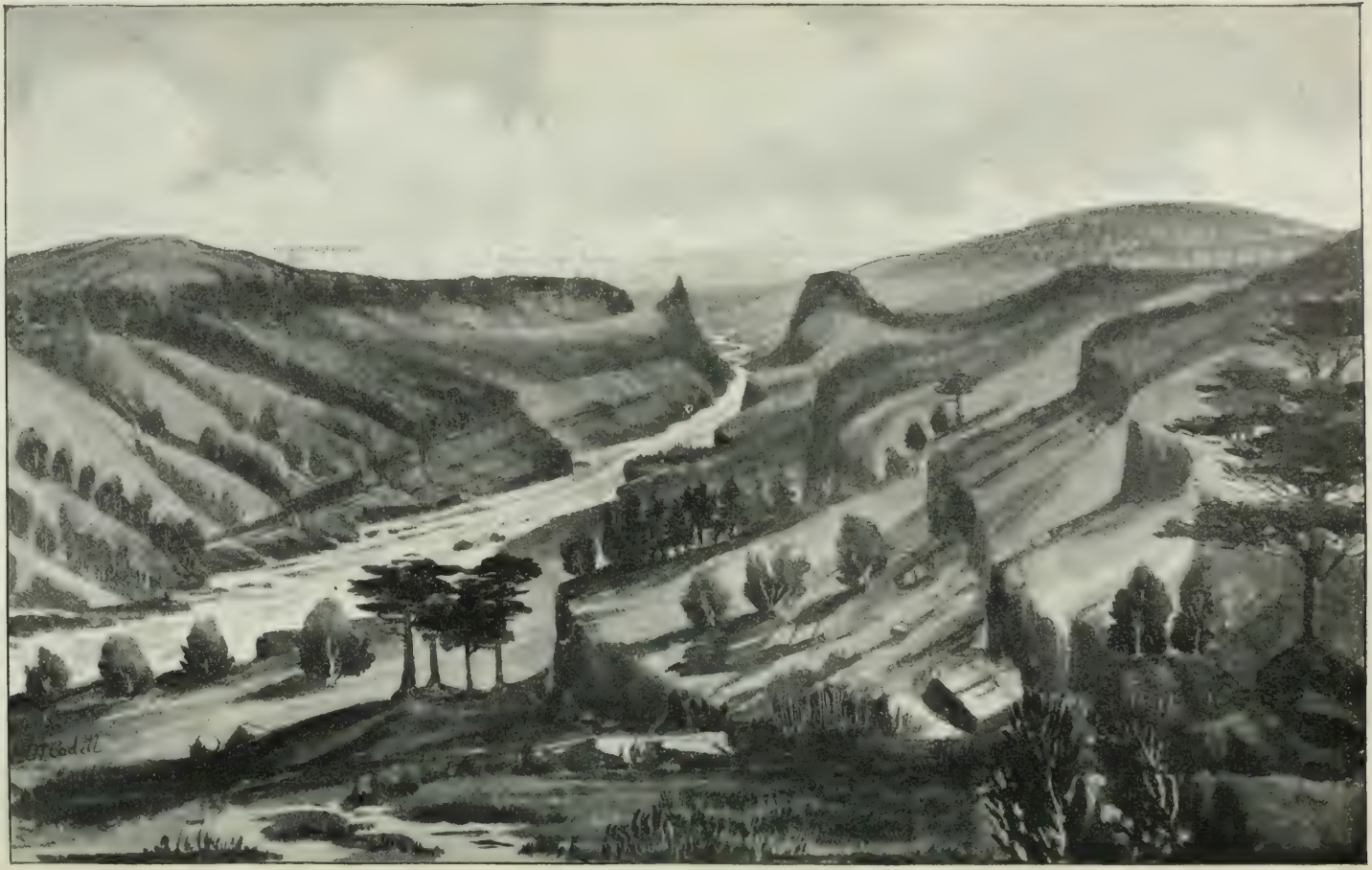

Fig. 11.—The ancient Forth valley at Queensferry with the shadow of the future Forth Bridge cast across it.

buried gorge of the Kelvin was found to have perpendicular and even overhanging walls at some spots. It must likewise have had a steep declivity and a swift current. Now let us take the gradient of a river such as this at say seven feet per mile, which is much less than that of some of its tributaries, but is nearly the average declivity of the Colorado River for 218 miles through the Grand Cañon district. Let us now multiply this by the distance between Stirling and Queensferry—23 miles as the crow flies—and we find that we must add about 160 feet to the depth of the gorge, which below the bridge must thus be at least 460 feet below the level of Inch Garvie. In other words, if the land were again upheaved to its ancient position, and the water and mud were swept away, the north cantilever instead of stretching across the sea at a height of 120 feet, would be found to span a chasm 160 feet deeper than that of the Zambesi, with a swiftly rolling torrent no less than 580 feet below the level of the rails. (See Fig. 11.)

But the old river, no doubt, ran far beyond the Bridge, and therefore the whole elevation of the land above its present level was probably far more than 400 or 500 feet. The North Sea between Scotland and Denmark is, except at a few places, less than 50 fathoms deep, and therefore, if the land were lifted even 300 feet, *that vast expanse of ocean would nearly all be dried up*, and the British Islands would become merely a mountainous portion of the European continent projecting out into the North Atlantic.

At the time we are speaking of, the buried river shows that this was the condition of our country; the North Sea had no existence, and we had no silver streak drawn around our shores by a kind providence, but only a vast plain on our eastern border, across which the Forth, Tay and other rivers meandered away outwards and perhaps became tributary to some greater river flowing into the Arctic Ocean. If the climate was no colder than it is now, the addition of 500 feet to the mountains would also raise the higher summits above the snow-line, and the melting snows in spring would greatly add to the floods in the Highland rivers.

The second or economic aspect of the subject relates to the effect of these concealed channels on mining and tunnelling operations. Serious accidents have happened at other places besides Crombie Point, where old river courses have suddenly been met with. Dr. Croll says the late Mr. Dawson of Carron told him that about eighty years ago the miners in the Carronshore pit cut into the trough of the Carron at a depth of forty fathoms, and the running sand rushed in with irresistible pressure and filled the working. Mr. Bennie described a similar disaster where the old Kelvin gorge was struck in a colliery near Duntocher at a depth of fifty-one fathoms, and the sand burst in and killed several miners.

Various proposals have been made to connect the north and south shores by driving tunnels under the Forth, but in view of the hidden river bed, it is perhaps well that none of these have been attempted. In 1880, after the fall of the Tay Bridge, a scheme was set afoot to run a tunnel from Hound Point to Donibristle instead of risking a dangerous bridge. From a copy of the plan in my possession it appears that there

was to be a line of railway running from Granton along the shore to Cramond where the tunnel was to begin. At Cramond the line was to be continued underground in a tunnel running downwards at a gradient of 1 in 75 until at Hound Point near Dalmeny it had reached a depth of 200 feet. At this depth it was to bend northwards under the sea and run to Donibristle on the north shore, where it was again to bend eastwards and emerge to the west of Aberdour. Now it will be clear from what has been said that this scheme was proposed in entire ignorance of two buried channels crossing the line of the railway, both considerably deeper than the tunnel level. First the old channel of the Almond at Dalmeny House, more than 200 feet in depth, would have to be pierced by the tunnel, which was proposed to be only 100 feet deep at that place, and secondly the far larger buried channel of the Forth probably filled with mud and sand to a depth of over 400, and perhaps 600, feet. Fortunately for the promoters the scheme never even reached the experimental stage.

Another proposal to tunnel the Forth at Kincardine Ferry, already referred to, was made by the North British Railway Company in 1890-91, when parliamentary plans were prepared, and some preliminary boring was begun. The tunnel was to be only about 59 feet below low-water level, and as the buried channel is more than 300 feet deep here, and it is probably full of soft mud and sand, the making of a safe tunnel through it would have been a very costly and dangerous piece of work if, indeed, it was feasible at all.

Another practical point may be noted in conclusion. When the original ill-fated Tay Bridge was designed in 1870 it was expected that the solid rocky bottom that had been found near the shore on both sides would extend all the way across the estuary and afford a good foundation for the heavy brick piers on which the superstructure was to rest. But alas for these unscientific expectations! After the bases of fourteen piers had been safely laid from the north side to a distance of 516 yards along the line, the rock suddenly began to slope down to an unknown depth, and when No. 15 pier was sunk it only touched the rock on the north side, but the south side having a soft bottom caused the structure to cant over so dangerously that it could not be righted and had to be demolished. This led to the alteration of the whole plan, as the greater part of the bottom was found to be soft from No. 14 pier to the south shore, and unable to bear the heavy superstructure originally designed for the piers.[1] It is now a matter of history how, on the dark stormy night of 28th December 1879, this frail cast-iron superstructure proved unequal to the strain, and the thirteen large spans in the centre gave way about a year and a half after the bridge was opened, precipitating a passing train into the deepest part of the river with ninety passengers, not one of whom escaped to tell the tale. The Board of Trade inquiry proved that the fault lay principally in the cast-iron columns bearing the girders, which had been badly made and too cheaply

[1] *Vide* Mr. Albert Grothe's description of the *(First) Tay Bridge; its History and Construction* (Dundee, John Leng and Co., 1878), written just after the opening of the railway.

erected, and as they were an afterthought consequent on the belated discovery of the buried channel, it becomes evident now that the engineers' want of geological knowledge of the old river system was an important contributory cause to that terrible calamity. Engineers cannot afford to discard scientific evidence, and this investigation may perhaps be of use in connection with other schemes for bridges over or tunnels under British estuaries, as buried channels will no doubt be found to exist at many other places besides those I have spoken of.

## THE BRITISH ANTARCTIC EXPEDITION.

THE *Terra Nova*, the ship of this expedition, arrived at Akaroa, New Zealand, on April 1, without Captain Scott, who has remained in the Antarctic for another season's work.

According to the reports brought back by the ship, the task of laying down depots last year proved very difficult owing to the great severity of the weather. In March 1911 three ponies were lost as the result of a blizzard, and the greatest hardships were endured during these terrible storms. The winter temperatures were moderate, and the arrangements for the lighting and heating of the hut proved quite satisfactory. In mid-winter Dr. Wilson, Mr. Cherry Garrard, and Lieutenant Bowers made an expedition to Cape Crozier to observe the incubation of the Emperor penguins at their rookery. Some eggs in different stages of development were obtained, but the temperatures were exceedingly low (rarely above $-60°$ F., often below $-70$, with a minimum of $-77°$), and storms of great severity were encountered.

The final start for the southern journey was made on November 2, marching being carried on by night, and the day used for resting, so that the ponies might have the benefit of the higher day temperatures. The motors had to be abandoned after 60 miles owing to the overheating of the air-cooled engines, but they dragged heavy loads over the worst part of the Barrier in a highly satisfactory fashion. The weather was very bad during the advance, severe storms being experienced, especially in early December, when a southerly gale raged for four days, accompanied by a very heavy snowfall. The new snow made progress over the Beardmore Glacier excessively difficult, and reduced the day's march to scarcely five miles. Later better progress was made, averaging 13-23 miles per day. By January 3rd the party had reached 87° 32′ S., at a height of about 9,800 feet. They were thus some 150 miles from the Pole, which Amundsen (cf. p. 204) had reached more than a fortnight previously. On the following day Captain Scott sent back his last supporting party, and went forward himself with four companions, these being Dr. Wilson, Captain Oates, Lieutenant Bowers, and Petty Officer Evans. The returning party consisted of Lieutenant Evans and two companions, and they had a terrible journey owing to the fact that Lieutenant Evans was attacked by scurvy, and while still nearly a hundred miles from the Discovery Hut proved unable to go any further. His two companions, Crean and Ashley, dragged him for a considerable

distance on a sledge, but the heavy snowfall and the shortage of food made it impossible for them to get further than Corner Camp, over thirty miles from the Hut. From this point Crean set off alone for the Hut, leaving Ashley behind to nurse Lieutenant Evans, who was very seriously ill. Crean reached the Hut after a march of eighteen hours, and a rescue party was sent off at once, and succeeded in bringing the invalid first to the Hut, and then to the ship, on which he returned to New Zealand. His condition rapidly improved with treatment, and he is now convalescent.

The ship finally left Cape Evans on March 5, leaving behind in the field not only Captain Scott and his party, but also Lieutenant Campbell's party (the northern party). This party consists of Lieutenant Campbell, Dr. Levick, Mr. R. E. Priestly, Petty Officers Abbot and Browning, and Seaman Dickason. It proved impossible for the ship to pick them up in Terra Nova Bay, as was intended, but they were provisioned against this contingency, and will make their way to the winter quarters at Cape Evans.

The western geological party, in charge of Mr. Griffith Taylor, made two expeditions, one lasting six weeks from January 27, 1911, and another lasting from November 7, 1911 to February 15, 1912, when the members were picked up by the ship on the Blue Glacier and brought to Cape Evans. During this second expedition the party were obliged to abandon their specimens at Granite Harbour, but it is hoped that the ship will be able to get these in 1913. These two geological expeditions have resulted in the survey, in some detail, of the whole coast from north of Mount Morning to Granite Harbour, and a number of interesting geological and physiographical observations were made.

There is every reason to believe that Captain Scott proved successful in reaching the Pole, as the party were in excellent health when Lieutenant Evans and his companions quitted them. Their return journey should also be easier than that of Lieutenant Evans, as they were to be met from the winter quarters by a supporting party with two teams of dogs. The *Terra Nova* will return towards the end of the year to pick up the different parties.

The expedition has carried out its programme of scientific work, and has obtained some valuable results. Continuous meteorological observations have been carried out at winter quarters. The upper atmosphere has been investigated by means of small balloons, which have shown the direction of the upper air currents to heights of six miles, and have recorded temperatures to a height of five miles. Magnetic observations have also been carried on. Specimens of coal of economic value, and also fossils, have been found in Granite Harbour. Pendulum observations have been made, a tide gauge which was set up has given a continuous record, and a number of biological observations have been made, some new protozoa having been found. On board the ship also, dredging operations have been carried out with success, and continuous meteorological observations have been made. Many cinematograph films illustrating the life of the birds and mammals of the Antarctic have been obtained.

## THROUGH TRACKLESS LABRADOR.[1]

THIS handsome and beautifully illustrated book will appeal successfully to a great variety of readers. In the first place, for geographers it is the record of the successful accomplishment of a very arduous and interesting piece of original exploration. Mr. Prichard, an old Fettes boy, is well known as an explorer and a sportsman. In 1903 he made a more or less unsuccessful expedition into Labrador with a view to shooting cariboo, but his failure on that occasion seems merely to have stimulated him to continue his exploration of unknown Labrador, and his determination in this respect was not shaken even by the disastrous experience of the Hubbard expedition a year or two afterwards. He found a congenial and trusty comrade in Mr. E. M. Gathorne Hardy, and between them they resolved "to try to draw a line across the blank area which on the maps represents north-eastern Labrador between the Atlantic and the George," and they settled on the missionary station of Nain as the best point of departure from the coast. They were accompanied by a sturdy and faithful Newfoundlander, Robert Porter, and left England for Labrador on the 22nd June 1910, having been fortunate enough to secure berths on the Moravian mission-ship *Harmony*.

They reached Nain in a little less than a month, and received a cordial welcome and every possible assistance from the kind Moravian missionaries there. The expedition was here reinforced by an Eskimo, Boaz Obed, but a few days after the party had left Nain, Boaz Obed made a demand for more pay, and when this was refused he decamped during the night. It was obvious that he had made every preparation for this treachery, as he had with him a private supply of whale meat and seal oil for his return journey. The party left Nain in two canoes on the 23rd July, and made for Nunanigoak Bay, into which the Fraser River runs. After some days of great discomfort from rain and mosquitoes, and danger from shoals and rocks, they passed up the bay to the north of the Fraser River. Boaz deserted them on the night of the 1st August, and so they had to cache one of the two canoes. By the 3rd August they found that it was impossible to push the canoe any farther up the river, so they dragged it ashore at a ravine in which they had seen a black bear, and they decided to ascend to the plateau there. It was no easy business carrying the canoe, provisions, a gun, a rifle and ammunition, a fishing-rod, etc., up the ravine 1500 feet from the level of the river, but the whole portage was safely accomplished by the 8th August. From the top of the ravine they could see the country over which they were to march. Mr. Prichard describes it thus: "It is a wonderful place, this roof of Labrador. Ridge on ridge, some of considerable height, roll away seemingly to the world's end. In the valleys and cups of the hills lie thousands of nameless lakes. The winds, during the greater part of the year, rage over

[1] *Through Trackless Labrador.* By H. Hesketh Prichard, F.R.G.S. London: William Heinemann, 1911. *Price* 15*s. net.*

it. It is sheer desolation, abysmal and chaotic. Of dominant notes there are but two, the ivory-coloured reindeer moss and the dark Laurentian stone. On the flanks and on the peaks of the mountains, in the beds of the brooks, on the shore of the lakes all over this huge tableland, are strewn the great Laurentian boulders in their infinite millions—gigantic and glacier-born seeds sown in the dawning of the world. When the sun shines, to quote Saltatha, the Yellowknife Indian, 'the lakes are sometimes misty, and sometimes blue, and the loons cry very often.' Then it is a land of stern and imposing beauty, perhaps unlike any other on earth, where sky and clouds are mirrored in the shallow lakes, and the lazy monster fish rise among the ripples in the red and gold of evening. But when the clouds ride it, and the wind and rain, sleet and snow rave over it, as they do nearly all the year round, a desolation more appalling cannot be conceived. There is no shelter for him who travels it; hardly one of the glacier-driven stones is more than four feet high; every lake is whipped into wrath and thunders on its shore; the loon may cry out there in the storm, but no human ear could hear him. Lucky the man if he can find a rock beneath which to creep, and in that cold refuge shiver as he peers out and watches the elemental Spirit of the Tempest rejoicing in what seems to be the very heart of his kingdom."

The intrepid explorers then realised that there were two dangers on which they had not sufficiently calculated: the one the want of fuel for cooking purposes, and the other a possible deficiency of game for food. As to the physical discomforts arising from rain and wind, they were trifling as compared with the tortures which they suffered from mosquitoes. "While we were fishing the mosquitoes swarmed over us, nor as the sun rose higher did it bring any relief from, but rather a reinforcement to, the hosts of Beelzebub, the Lord of Flies. We had grown used to them in the valley of the Fraser, and suffered as we then believed almost to the limit of endurance, but we had buoyed ourselves up with the hope that the wind and the chill of the high ground would rid us of the bloodthirsty battalions. Far from it. We soon discovered that the mosquitoes of the river valleys were but sluggish and incompetent regiments as compared with the armies of these hardy mountaineers, whose vanguard stabbed us with red-hot needles sent well home. As to their numbers, I am hopeless of giving any idea of them. Suffice it to say that when Hardy put his military blanket out to air, phalanxes three or four deep settled upon it, until its colour changed from brown to grey—a seething and loathsome mass of insects; and presently, as we moved about, above each of us rolled a pillar of mosquitoes, revolving and buzzing, and thousands strong." As a matter of fact, the party were fairly well supplied with fish by Mr. Hardy, and now and again they shot a cariboo. Undeterred by misery and danger they continued their march westward, till on the evening of the 18th August Mr. Prichard slipped and strained his ankle and a tendon, but on the 19th they found that they had reached their goal, the widening of the George River known as Indian House Lake. Of it Mr. Prichard says: "The hollow of the valley which is filled with

that great widening of the George called Indian House Lake is a mile in width and about twenty in length. On either side of the river rise high rolling ridges, dotted with spruce, willow, and juniper, which grow freely among immense boulders and masses of rock. The whole of the land surface is seamed with the old trails of cariboo that have pursued their age-long wanderings in this desolate region." There the party had to halt in order to let Mr. Prichard recover from his sprain, and they managed to secure a useful supply of fish and cariboo flesh. On August 29 they began the return journey eastwards; on the 4th September they reached the Fraser River, and were welcomed again by their friends at Nain on the 9th September, having successfully accomplished the task they had taken in hand.

We have left ourselves but little space in which to mention the other attractions of this book. The philanthropist will find in it a sincere and happy appreciation of the benevolent work done by the Moravian missionaries, the Rev. Mr. Stewart and the well-known Dr. Grenfell, whose sympathetic and able book on *Labrador* we reviewed some time ago (*S.G.M.*, vol. xxvi. page 278). Mr. Prichard has nothing but praise for the self-sacrifice and zeal of the devoted ladies and gentlemen who spend their lives in the service of the Eskimo.

The ethnologist will find a most interesting chapter on the Eskimo of to-day. Mr. Prichard has no special theory of his own to broach as to their origin or movements. He leaves that to savants like Rink or Boas or Steensby. He contents himself with a vivid and graphic picture of the Eskimo as he found them, and he takes the opportunity of urging on all to whom they are an object of interest, that the policy pursued by the Moravian missionaries in their treatment of the Eskimo is the wisest, the kindest, and the best. Put tersely it is this, that the Eskimo should be kept as much as possible apart from civilisation, for "as civilisation advances up the coast—outside the limit of Mission influence—the Eskimo race dies out and disappears. . . . Nature is confessedly cruel to the wild peoples, but civilisation is infinitely more so. Before her advance wild game and wild tribes vanish away as a lake mist vanishes under the coming of the sun." Mr. Prichard confirms what Dr. Grenfell pointed out in his work on *Labrador*, that the Eskimo is a man "of no small intelligence. All those at the Moravian settlements are fairly educated, very few indeed being unable to read and write. In this they are far ahead of many of the white settlers of southern Labrador, and even of a large proportion of the population in some of the Newfoundland outposts." The white settlers, or "liveyeres," are not, on the whole, a very interesting or a very hopeful people, living as a rule from hand to mouth, and sinking lower and lower in the social scale.

The Indians of the interior of Labrador, the Montagnais and the Nascaupees, form the subject-matter of a very interesting and thoughtful chapter. They are a rapidly dwindling race, being, it is supposed, now only some four thousand in number, and eking out a precarious livelihood by hunting and fishing. "They call no man master, and they live a life of hardship and freedom such as was more common in the world of a

hundred years ago." Happily the old feud between the Indians and the Eskimo has now been extinguished.

Lastly, for the sportsman, in addition to the many notices about the fauna of the country recorded in the narrative of the expedition, there are most interesting chapters on the cariboo and on the fish of Labrador —the chapter on the latter by Mr. Hardy. The volume concludes with a graphic and well-balanced comparison between the attractions and expense of a sporting expedition in Labrador and one in Norway, very much in favour of the expedition to Labrador. But, the MOSQUITOES ! !

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## GEOGRAPHICAL NOTES.

### EUROPE.

**The Shores of Provence.**—M. Raoul Blanchard contributes to *La Géographie* for October 15 last an interesting article on this subject, whose main thesis is that, on this coast at least, the action of the sea in modifying coastal form is very much less important than continental influences. The author believes that when, as here, the sea is deprived of the assistance of appreciable tidal currents, its effect is limited to minor modifications of form—"it works upon a canvas which it did not supply." In detail an interesting point is the description, as a special coastal form, of the type of gulf called locally a *calanque*, of which the gulf of Port-Miou, and much further east the beautiful Bay of Portofino, are examples. A calanque, according to M. Blanchard, is a ria in the early stage, that is, a partially-submerged river valley. Such inlets are excessively numerous between Marseilleveyre and Cassis, and are narrow, with usually steep walls. The water is usually deep, but diminishes rapidly towards the interior, and landwards the gulf is prolonged into a small river valley. Port Miou is a calanque which reaches a considerable size, and is transitional to a true ria, but the number of small steep-sided inlets seems sufficient to justify the use of a new term.

### AMERICA.

**Expedition to Newfoundland.**—According to *Science*, Prof. R. S. Tarr, of Cornell University, is to conduct an expedition to Newfoundland during the coming summer, to which a limited number of students will be admitted. The geology and physiography of the island will be studied in the field, the party carrying its own camping equipment.

### POLAR.

**Argentine Antarctic Station.**—Mr. R. C. Mossman informs us that the relief of the meteorological observers at the South Orkneys was effected at the end of February by the s.s. *Udine*, a vessel belonging to the "Argentine Fishing Company" of South Georgia and Buenos Ayres. The observers report that the winter was exceedingly mild. Scotia Bay froze for the season on June 28 and opened on September

23, November was very cold with southerly winds throughout, but after the middle of December temperature was above the average, the summer being described as "fine and quiet."

Emperor penguins were seen and specimens secured in March and April, and early in August several Gentoo penguins were observed.

A Norwegian whale fishing company has commenced operations around the islands, having found a fine, secure harbour in Washington Strait, where, owing to the strong current, there is little chance of the vessels being beset by pack ice. The *Uruguay* left a new party to continue the work during the present year for the Argentine Meteorological office, under the command of Lieutenant Stranger of the Norwegian Navy, who was a member of the Argentine party in 1910.

**The American Crocker Land Expedition.**—In reference to the Note on this subject in our last issue (p. 211), it may be pointed out that a very full account of the objects of the expedition, accompanied by a clear map, appears in *Science* for March 15. Among the interesting points which are to form the subject of special investigation may be mentioned the "glacial fringe" of the north coast of Grant Land, which offers a certain analogy to the Ross Barrier of the Antarctic, though on a smaller scale. The glacial fringe is not a true glacier, but a combination of glaciers from the land and the heavy ice of the fiords, which extends seawards for about five miles, forming a kind of piedmont glacier. This fringe gives rise to the floe-bergs and the many heavy ice-flows of the Polar seas, and is thrown into great swells or waves thirty to forty feet high, which run normal to the shore. Its peculiarities render it very important that it should be studied in detail.

## General.

**Royal Geographical Society's Awards.**—The two Royal Medals of the Royal Geographical Society have been awarded this year to Mr. Charles Montagu Doughty and Mr. Douglas Carruthers, the Founder's Medal to the former and the Patron's Medal to the latter.

Mr. Doughty has rendered great service to geographical knowledge by his remarkable exploration of Arabia. His book is still the best authority on the Bedawi life, and his discoveries on the hydrography, orography, and geology of the peninsula are the foundation of our knowledge in those matters.

Some six years ago Mr. Carruthers was a member of the special expedition to Mount Ruwenzori. In 1908 he joined Mr. Rickmer Rickmers, devoting many months to an exploration of the Arpa and Aksai plateaux in Russian Turkestan, an account of which he communicated to the Society, with a map. In 1909 he accomplished under considerable difficulties a journey in North-Western Arabia, for which the Society awarded him the Gill Memorial. In 1910 and 1911 he, together with a geologist and a naturalist, carried out an expedition in North-West Mongolia, including the upper basin of the Yenesei, the Altai mountains, and neighbouring regions.

The Victoria Medal, which is specially awarded for scientific research in Geography, has been conferred upon Sir George H. Darwin, K.C.B., F.R.S., who is the leading authority on tides. The Murchiston Bequest has been conferred upon Captain W. C. Macfie, R.E., for his work in connection with the Uganda Topographical Survey. The Gill Memorial has been awarded to Captain F. M. Bailey, whose paper on his latest journey we published in our last issue (p. 189), with a map. The Back Bequest has been awarded to Mr. L. A. Wallace who, while acting as chief surveyor in North-Eastern Rhodesia, explored the Tanganyika Plateau and the neighbouring country, and by his surveys greatly increased geographical knowledge of the region.

**International Geographical Congress.**—We have received an intimation to the effect that the Tenth Geographical Congress, which was to have been held in Rome in October 1911, and was postponed, is to be held there in the week beginning March 27 next year (1913).

## EDUCATIONAL.

Gilchrist Studentship in Geography.—It is announced in the spring number of the *Geographical Teacher* that the Gilchrist Trustees have resolved to grant an Annual Studentship in Geography, of the value of £100, for advanced work in the subject, to be open to teachers who have an adequate knowledge of geography and some experience in teaching it. Applications for the studentship should be sent to the Hon. Secretary, Geographical Association, 40 Broad Street, Oxford, not later than April 25 each year. Applications will be considered by a committee consisting of representatives of the Council of the Royal Geographical Society, the Committee of the Geographical Association, and the Gilchrist Trustees, and the full regulations laid down by this joint committee will be found in the *Geographical Teacher*.

German Ordnance Survey Maps.—A very interesting development from the educational point of view has recently taken place in Germany in connection with the completion of the map of the German Empire on the scale of 1 : 100,000 (about 1½ miles to the inch). The *Königliche Preussische Landesaufnahme*, the equivalent of our Ordnance Survey Office, has arranged to issue, not to educational establishments only but to all persons desiring them for purposes of study, a selection of forty sheets of this map, chosen for teaching purposes, for the sum of six marks (see p. 280). This, it will be found, works out at 1½d. the sheet, the same price as that for which our inch-to-the-mile sheets are supplied to teachers, but these sheets are only supplied in bundles of not less than 200, which means a considerable outlay as compared with the 6s. which is the German minimum. Further, and this is a point of great interest, Dr. Walter Behrmann, of Berlin, has prepared a series of notes for teachers (*Belgeitworte*) on the forty sheets, pointing out the special features which

each shows. These notes appear in the *Zeitschrift der Gesellschaft fur Erdkunde zu Berlin* (Nos. 9 and 10, 1911), but a copy is also supplied to each purchaser of the forty sheets. In addition to his notes Dr. Walter Behrmann includes in his paper a list of the more interesting sheets of the survey map, classified according to the special features illustrated. Thus certain sheets are named as illustrating volcanic phenomena, others various glacial features, etc. etc. The subject seems to us one of great interest and importance, and we hope that it will receive here the attention which it merits. So far as we know there is in this country no publication directing the attention of teachers to Ordnance Survey sheets which illustrate special problems of physical geography, and the text-books used quite frequently give distant examples of phenomena which are admirably illustrated in many parts of Scotland. Further, in the Scotch Education Department's Memorandum on the *Teaching of Geography in Scottish Primary Schools*, about which we hope to say something here later, there is, despite the elaborate instructions in regard to the use of Ordnance Survey sheets in schools, no suggestion as to how pupils may be taught to recognise natural features on the maps, or how they may be used to illustrate lessons on these. In such matters we seem always to lag behind other parts of the world. Elsewhere the notion that large scale-maps should be used only in the detailed study of the geography of the neighbourhood in which the school is placed is rapidly giving way to wider conceptions. Here, on the other hand, the idea seems to remain that their chief use is to serve as a basis for elaborate and excessively tedious calculations of areas and distances, and for the making of uninstructive sections, all likely to render the map an object of loathing to the scholar rather than to lead him to regard it as a document of surpassing interest and great usefulness.

## NEW BOOKS

### EUROPE.

*The History of the Castle of York from its foundation to the present day, with an account of the building of Clifford's Tower.* By T. P. Cooper. With numerous illustrations, etc. London: Elliot Stock, 1911. *Price* 12*s.* 6*d. net.*

Mr. Cooper has brought together a store of antiquarian lore bearing upon the history of York Castle—the site of which is now mainly occupied by prisons and a Court House—and of Clifford's Tower, its one remaining feature of prominence. The tower is all but unique in style, and possesses the further interest of being erected upon an artificial mound. While this volume makes its appeal mainly to its own neighbourhood, there are items in it of wider range, as in the disquisition upon local scaffolds and capital punishment. The information is not arranged with conciseness, but then there are both a table of contents and an index.

### ASIA.

*A Journalist in the Holy Land: Glimpses of Egypt and Palestine.* By Arthur E. Copping. Illustrated by Harold Copping. London: The Religious Tract Society, 1911. *Price* 5*s. net.*

The number of books on the Holy Land is legion. The profound interest in

this small country, the theatre of events that have moved the world, attracts the pen of every visitor that can portray life and scenery. There was room for a journalist's description—light, vivid, sparkling, with the touch of the sensational and the subjective, so dear to a journalist's heart. Mr. Copping's account is in full accord with his profession. It is lit up by the numerous illustrations of his brother, who was on a sketching expedition for the Religious Tract Society. He carries his readers first of all to Egypt, and affords them glimpses of that fascinating land. He enters Palestine by Haifa, where he joins his brother. They make their way by Acre, Nazareth, and Cana to Tiberias and the Sea of Galilee. They then turn south, and pass through the land of Issachar to Samaria, Bethel, and Jerusalem to terminate their journey, curiously enough, after a visit to Bethlehem, at the Dead Sea. It is thus but a limited portion of the Holy Land that the author covers. Nature appeals as strongly to his imagination as the people he encounters, some of whom are so friendly and some so hostile. But the interest never flags. He adds a book to the library of the "Sunny East," whose pages the visitor will delight to peruse, and the sojourner at home to study and envy. He does not pretend to extend geographical knowledge, and does not even furnish his book with a map. The illustrations by Harold Copping enhance its value, and the book is handsomely produced by the publishers.

*From Constantinople to the Home of Omar Khayyam.* Travels in Transcaucasia and Northern Persia for Historic and Literary Research. By A. V. Williams Jackson. New York: The Macmillan Company, 1911. *Price* 15*s. net.*

The author, who is already well known by his volume on *Persia, Past and Present*, describes in this work his journey in 1907-8 from Constantinople along the shores of the Black Sea and the Caspian and across Northern Persia. The illustrations with which the book abounds are either from photographs by the author or his fellow-traveller or from pictures sent by friends in Persia. The tour was undertaken for the purpose of scholarly research, the author being Professor of Indo-Iranian languages in Columbia University, U.S.A., and being assisted in preparing this work by learned American colleagues. It is thus no ordinary book of travel, but a work of value such as only a scholar could produce.

While pronouncing the so-called "Sarcophagus of Alexander the Great" the gem of the Imperial Ottoman Museum at Constantinople, the author dismisses the idea that it ever received Alexander's body, although he is unable to accept any of the many conjectures as to its original occupant. He sailed from Constantinople to Sevastopol ("the august City"), founded by Catharine II. in 1784, and from there drove fifty miles to Yalta, whence he crossed the Black Sea to Batum, which is connected with Baku on the Caspian not only by railway but by 600 miles of pipe-line which make Batum the western headquarters for the shipment of petroleum oil obtained from the two thousand naphtha wells near Baku. The Fire Temple of Baku is traditionally associated with the fire-worshipping cult of Zoroaster (600 B.C.), which was supplanted in the seventh century A.D. by the creed of Islam. The author describes the temple and its inscriptions and considers that, as we now have it, the temple is a Hindu product of Northern Indian origin, for in Northern India fire-worship was cultivated from the ancient time of the Vedas. Thus, to his regret, the Zoroastrian legend vanished. Even the sacred flame of the temple was bought and extinguished by the Baku Oil Company.

During an excursion to the seldom visited town of Derbent on the Caspian the author discovered on one of its famous gates Arabic inscriptions dating from 1044 A.D. and photographed them. He then sailed to Angali, the Caspian port

for Teheran which, after an excursion to Lahijan, and its Zoroastrian arch, he reached by the highway controlled by the Russian Road Company, which runs carriages in about forty-eight hours over the 200 miles between Rasht and Teheran. At the latter he visited the Shah's palace and saw the "Peacock throne," which he describes, and criticises Lord Curzon's arguments regarding it. He noticed the signs of political progress at Teheran since Persia had adopted a Constitution and national assembly.

He then departed "on the track of Alexander the Great" to Mashad, a journey of 610 miles performed in post-phaetons each drawn by four horses. He made excursions from Damghan to Frat and Tak, near which Alexander found the body of Darius who had been slain by traitors and deserted by all but his dog. Alexander accorded his rival royal honours and sent his body for burial at Persepolis. At last the author reached Nishapur, the home of Omar Khayyam, author of the famous *Rubaiyat*, and visited the tomb where he was buried about 1123 A.D. Nishapur is one of the most ancient and celebrated cities of Iran, and existed several centuries before Christ. A day's journey from it is Mashad, the Holy City of Persia, which grew up round the tomb of the saintly Imam Riza who died 817 A.D. He was buried near the renowned Caliph Karun ar Rashid.

Even at Mashad the author declares he heard "the voice of the Nationalistic movement" which has transformed Persia. He visited Tus, the home of Persia's great epic poet Firdausi, who died about 1025 A.D., and he tried to locate the poet's grave. Two days later he crossed the Persian frontier en route for Transcaspia and Turkistan, and his researches and adventures there will be narrated in a forthcoming volume.

## AFRICA.

*The Making of Northern Nigeria.* By Captain C. W. I. Orr, R.A. London: Macmillan and Co., Limited, 1911. *Price* 8*s.* 6*d. net.*

In the making of Northern Nigeria two names stand prominent among those of a number of able and devoted officers; these are the names of Sir George Taubman Goldie and Sir Frederick Lugard. It is hardly too much to say that Sir George Taubman Goldie was the creator of the present Protectorate, for he, in 1877, was the first to forecast the possibilities of the country, and with persuasive tact to induce the various traders to combine in forming the United Africa Company, which, three years later, became the National African Company. Political events, and especially an international scramble for territory on the west coast of Africa, forced the unwilling hands of the Government at home, and in 1886 the Company was granted a charter, under which it, at one and the same time, traded and governed. At the beginning of 1900 the administration of Nigeria was assumed by the Colonial Office; Northern Nigeria was separated off from Southern Nigeria, and Colonel (now Sir Frederick) Lugard was appointed the first High Commissioner. In this very interesting work Captain Orr, who served for seven years in the Political Department, introduces his main subject by a brief and lucid sketch of early exploration in Nigeria and of its history in the days of the Company and under the management of Sir George Taubman Goldie, to whose constructive ability and administrative skill he does ample justice. The greater part of the work, however, is devoted to an account of the internal history of the Protectorate between the years 1900 and 1910. The book should be read by every one interested in the way our colonial empire is shaped and administered. The work of initiating a new administration in a turbulent, barbarous, and fanatical region, where inter-tribal war and slave-raiding had been prevalent for centuries, was no

mean test of the comprehensive foresight and constructive genius of Sir Frederick. A mere enumeration of the departments of administration conveys some idea of the work which he had to plan out and set a-going. His departments were Political, Secretariat, Treasury, Judicial, Police, Prisons, Medical, Marine, Public Works, Postal, Transport, etc. ; and in accordance with the traditions of the home authorities the whole administration of a territory exceeding 300,000 square miles in area had to be conducted at a minimum of expense. "The first task which presented itself to the new High Commissioner was the pacification of the country, the prohibition of inter-tribal war and slave-raiding, and the dispersal of armed forces ; the next, the securing of the goodwill of the chiefs and people and the establishment of an efficient civil administration combined with the strengthening of such as already existed in the native states themselves." How these tasks were carried out and how the newly acquired territory prospered under the strong, judicious, and tactful administration of Sir Frederick Lugard, his successor, and their subordinates, is the subject of several interesting chapters, exceedingly well told by Captain Orr. Of late we have had many excellent books dealing with the administration of our colonies and dependencies, and it is due to Captain Orr to say that the volume now before us will find a place among the best of them. In the concluding chapters he sets forth succinctly and temperately some of the complex problems which are inevitably incidental to a comparatively new administration, *e.g.* questions of education, justice, land-tenure, and the like. On the wise solution of these problems the prosperity of Northern Nigeria will depend, and we have no reason to fear that the civil and military officers on the spot will fail to solve them successfully.

*On Horseback through Nigeria.* By J. D. Falconer, D.Sc. London : T. Fisher Unwin, 1911. *Price* 12*s.* 6*d. net.*

In a previous issue of this Magazine (*Scottish Geographical Magazine*, vol. xxvii. p. 554) we noticed at some length Dr. Falconer's able and comprehensive work on the mineral resources of Nigeria, *The Geology and Geography of Northern Nigeria.* In this, which may be called a companion volume, he describes the scenery and the inhabitants of the various regions through which his official duties as officer in charge of the mineral survey took him. He traversed practically the whole of Northern Nigeria, starting from Lokoja, at the junction of the Niger and the Benue, and marching east and north to the ruins of Kukawa and Lake Chad ; thence he came back south and west to Gujba, and from there he proceeded to Kano and Sokoto, where he turned south to the Niger. In the course of his travels he met with singularly few adventures, and he seems never to have been in personal danger, a striking tribute to the efficiency of the civil administration, which has established and maintains the *pax Britannica* in a vast region which only a few years ago was seething with internecine tribal wars, and where the principal method of livelihood was slave-raiding. It is true that, here and there, there are still tribes living at some distance from the administrative outposts, into whose lands it is risky to enter, but they no longer take the initiative in aggression, and it is merely a matter of time when they will all become fairly civilised. On the other hand, "the law and order which have been imposed alike upon Mahommedan and pagan, upon Hausa and Fulani, are, however, entirely foreign to the instincts and traditions of the people themselves ; and while at present their attitude is that of passive curiosity, the sameness and monotony of their existence must in time weigh heavily upon their active spirits. Unlettered ease is hard to endure ; and it is harder still for a rude and simple warrior to change the

whole tenor of his life and devote himself solely to agriculture, cattle-breeding, or petty trading." Dr. Falconer does not anticipate a speedy increase of imports into Nigeria, which produces within itself almost every thing it needs, and he prognosticates that in twenty or twenty-five years the profitable tin-fields (vide *Scottish Geographical Magazine*, vol. xxvii. p. 218) will be exhausted. Nigeria will then for the most part be dependent upon agriculture, an industry which can hardly fail to produce a marked change in the character and customs of its inhabitants. We may add that the book is illustrated with some excellent photographs, and there is a useful map.

*Nigeria: Its Peoples and its Problems.* By E. D. Morel. London: Smith, Elder and Co., 1911. *Price* 10*s.* 6*d. net.*

In this work Mr. Morel, the editor of the *African Mail*, has collected and reprinted a series of letters which he contributed to the *Times* some time ago, describing his observations and impressions during a tour he made throughout the colony of Nigeria. Mr. Morel is already well known through his other publications, more especially those in which he described the Congo State, and the Nigerian letters as they came out justly attracted some attention. They do not add anything to our stock of knowledge about the colony, but they contain a good deal of information, and are written with the easy style and fluency of the practised journalist, and in this respect will be acceptable to many readers. It is unfortunate that Mr. Morel again and again assumes an air of superior knowledge and of patronage of the system of administration and of the earnest and devoted officers who are engaged in the difficult work of carrying it on, for whom, however, he has evidently a sincere sympathy, and of whom he writes in most flattering terms. On the basis of the experiences of a brief tour he does not hesitate to dogmatise freely, and even to propose a new re-arrangement of the provinces and changes in the administration, such as we were accustomed to have from Pagett, M.P., and his congeners after a six months' tour in India. Apart from this the letters are eminently readable and interesting as the production of a capable and experienced observer, and they are a useful supplement to such other works as those of Captain Orr and Dr. Falconer. We may add the book is well illustrated with a number of good photographs.

## AUSTRALASIA.

*Through Polynesia and Papua, Wanderings with a Camera in Southern Seas.* By Frank Burnett, author of *Through Tropic Seas*, etc. London: Francis Griffiths, 1911. *Price* 12*s.* 6*d. net.*

This is the record of a year spent in travelling amongst the South Sea Islands and in New Guinea, where Mr. Burnett studied the ways of the natives and made collections of the handiwork of those primitive peoples. Sailing from San Francisco, his first objective was the island of Tahiti, in the Society group, which is under French protection, and we find some interesting notes on the islanders and their government. Like other French colonies, Tahiti is overrun with officials, and the author remarks on the traffic in alcohol which is permitted by the French for the sake of the revenue it brings in, though its effects on the natives are very disastrous. We are told that in the Society group there are some three hundred French officials, or one to every forty natives; whereas in the Cook Islands, now administered from New Zealand, there are only *twelve* white officials, or about one per thousand natives, and the sale of alcohol is absolutely forbidden. Speaking of

the well-known colossal idols or images, on Easter Island, Mr. Burnett advances a bold theory to the effect that the islands are the mountain tops of a lost Atlantis of the Pacific ; and that this submerged region was at one time the home of a race of immigrants from western Europe, the evidence of whose work is found in the megaliths referred to ; he notes also that the colossal trilithon in Tonga has been compared to those to be seen at Lanyon and St. Ives. Reference is also made to the "great migration" from the islands of Polynesia to New Zealand, which took place some thirty generations ago, and the evidence of which is now found in the language and traditions of the Maoris.

Mr. Burnett gives an interesting account of a visit to the colony of Adamites established in Tahiti, whose founder and high priest is a man named Dowling, an American, and one of whose tenets is that the adherents of both sexes should discard all clothing. The Adamites are socialists and vegetarians.

From Tahiti Mr. Burnett went on to Raratonga, the chief island and seat of government of the Cook Islands Confederation. They were formally annexed to the British Crown in 1900, and, after a short period of imperial rule, the administration of the islands was handed over to the Dominion of New Zealand. The natives are, of course, Polynesian, and they appear to be happy and contented under the Dominion government. We find some details of the mission laws which obtained prior to the annexation. Under these laws fines were exacted from the natives for drinking beer, with an extra fine added for consuming it on Sundays. This has been altered, but the following seems salutary : "Lawyers are not allowed to practice in the High Courts, where they were in the habit of complicating the issues, and of suggesting legal interpretations contrary to common sense and equity." Mr. Burnett makes no secret of his hostile attitude towards missions and missionaries in the islands generally, and, after making allowances for real grievances, it seems probable that he is not free from prejudice in this respect.

After Raratonga he next visited the Solomon group, which, he says, are "a land of battle, murder, and sudden death," which condition he ascribes to "the apathy and supineness of an incompetent government." The islands form a protectorate of Great Britain and are under a resident commissioner, who again is responsible to the high commissioner of the Western Pacific at Fiji. Mr. Burnett says "their administration is a disgrace to the British Empire. The ignorance betrayed by the *personnel* of the administration of all matters pertaining to good government is monumental, and is surpassed only by their colossal bumptiousness." The author has evidently a strong bias towards handing over the islands to the control of the Australian Commonwealth, and he is unsparing in his attacks on the present régime. The Solomon islanders are, as is well known, Melanesians, who are widely different in their ways from the friendly and cheery Polynesians. The former are a race of treacherous cannibals, and the white man in their midst is in constant danger. Mr. Burnett went about amongst them freely, but he was accompanied by a well-known and influential trader, and he was escorted by a guard.

The two concluding chapters deal with the writer's journeys in British New Guinea, and he speaks highly of the rule of the Australian Commonwealth there. Roads are being opened up, hospitals established, and the welfare of the native is strictly safeguarded. The author thinks that in a few years British New Guinea will be a great rubber-producing country, though the statements of some of the new companies floated in Australia are fraudulent.

The map which accompanies the book is on too small a scale to be of much value, and the illustrations are scattered about irrespective of their place in the

text. Some of the pictures of native women in deshabille might, we think, be suppressed with advantage.

### GENERAL.

*Climatic Control.* By L. C. W. Bonacina. London: Adam and Charles Black, 1911. *Price* 2*s.*

This book, one of the well-known series of Black's school geographies, should prove very useful to those for whom it is primarily intended. Following the introductory chapter on climatology come others treating of types of land in relation to climate, well-known lands in relation to climatic control, and the influence of climate upon man as regards indoor and outdoor life, race and nationality. The concluding chapter on meteorology, although intended for more advanced students, is unfortunately very brief. A useful list of meteorological works is included, and the illustrations consist of maps, diagrams, and five daily weather charts of the meteorological office dealing with such types of weather as thunderstorms, cyclonic storms, anticyclones, and snowy weather. Throughout the book special prominence is given to the study of the British climate and its effects.

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## BOOKS RECEIVED.

*An Elementary Manual of Statistics.* By Arthur L. Bowley, M.A., F.S.S. Demy 8vo. Pp. vi + 215. *Price* 5*s.* London: Macdonald and Evans, 1910.

*Der Kompass. I. 46 Tafeln und Verzeichnis derselben.* Von A. Schück. Pp. 17. *Price* 21 *Marks.* Hamburg: Selbstverlag des Verfassers, 1911.

*Alte Schiffskompasse und Kompassteile im Besitz Hamburger Staatsanstalten.* Von A. Schück. Pp. 47. *Price* 5 *Marks.* Hamburg: Selbstverlag des Verfassers, 1910.

*The Children's World.* By S. Shenessey. Containing 62 Illustrations, 32 of which are in colour. Cr. 4to. Pp. 64. *Price* 1*s.* 6*d.* London: Adam and Charles Black, 1912.

*Geographical Pictures (from Photographs). Series III. Sculpture of the Earth's Crust.* 2 Packets. *Price* 6*d. each.* London: Adam and Charles Black, 1912.

*The Story of Jerusalem.* By Colonel Sir C. M. Watson, K.C.M.G., C.B., M.A., etc. Illustrated by Geneviève Watson. Fcap. 8vo. Pp. xx + 339. *Price* 4*s.* 6*d. net.* London: J. M. Dent and Sons, Ltd., 1912.

*Handbook of Commercial Geography.* By Geo. G. Chisholm, M.A., B.Sc. (Edin.). Eighth Edition. Demy 8vo. Pp. lxvi + 666. *Price* 15*s. net.* London: Longmans, Green and Co., 1912.

*The Barbados Handbook.* By E. Goulburn Sinckler. Demy 8vo. Pp. xii + 203. London: Duckworth and Co., 1912.

*Scottish National Antarctic Expedition. Report on the Scientific Results of the Voyage of S.Y. "Scotia," during the Years* 1902, 1903, *and* 1904, *under the Leadership of* William S. Bruce, LL.D., F.R.S.E. Volume III., Botany. Twelve Plates and a Chart. Royal 4to. Pp. ix + 153. *Price* 23*s.* 6*d.* Edinburgh: The Scottish Oceanographical Laboratory, 1912.

*Animal Life in Africa.* By Major J. Stevenson-Hamilton, F.R.G.S., C.M.Z.S. With a Foreword by Theodore Roosevelt. Illustrated. Demy 8vo. Pp. xvii + 539. *Price* 18*s. net.* London: Wm. Heinemann, 1912.

*The Mafulu Mountain People of British New Guinea.* By Robert W. Williamson. With an Introduction by A. C. Haddon, Sc.D., F.R.S. With Illustrations and Map. Demy 8vo. Pp. xxiii + 364. *Price* 14*s. net.* London: Macmillan and Co., Ltd., 1912.

*Cambridge Geographical Text Books. Intermediate.* By A. J. Dicks, B.A., B.Sc. Cr. 8vo. Pp. xi + 362. *Price* 3*s.* Cambridge: University Press, 1912.

*The Land of Goshen and the Exodus.* By Sir Hanbury Brown, K.C.M.G. Second Edition, with two Maps. Sm. Demy 8vo. Pp. 92. *Price* 3*s. net.* London: Edward Stanford, 1912.

*The First and Second Sikh Wars.* Compiled for the General Staff, India, by Lieutenant-Colonel R. G. Burton. Med. 8vo. Pp. iii + 148. Simla: Government Central Branch Office, 1911.

*On the Backwaters of the Nile; Studies of some Child Races of Central Africa.* By the Rev. A. L. Kitching, M.A. With 56 Illustrations from Photographs taken by the Author, and a Preface by Peter Giles, Litt.D., Hon. LL.D. Demy 8vo. Pp. xxiv + 295. *Price* 12*s.* 6*d. net.* London: T. Fisher Unwin, 1912.

*The Seaside Resorts of Brittany from Mont-Saint-Michel to Saint-Nazaire: A Practical Guide-Book to the Balneal Stations, with Means of Communication and Principal Excursions.* 26 Plans and Maps, 81 Illustrations. (Joanne Guide Books—English Series.) Fcap. 8vo. Pp. 254. *Price* 4*s.* London: Hachette and Co., 1912.

*L'Ame d'un Peuple Africain: Les Bambara, leur Vie, psychique, éthique, sociale. religieuse.* Par L'Abbé Jos. Henry. Avec 11 Illustrations de Texte et 24 Planches hors Texte. Demy 8vo. Pp. v + 238. 10 *Mk.* Münster i. W.: Aschendorffschen Buch., 1910.

*Earth Features and their Meaning: An Introduction to Geology, for the Student and the General Reader.* By William Herbert Hobbs. Demy 8vo. Pp. xxxix + 506. *Price* 12*s.* 6*d. net.* New York: The Macmillan Company, 1912.

*Our Weather.* By J. S. Fowler, F.R.Met.Soc., and William Marriott, F.R.Met.Soc. (Temple Cyclopædic Primers.) Crown 8vo. Pp. xii + 131. *Price* 1*s. net.* London: J. M. Dent and Son, 1912.

*Fifth Census of Canada*, 1911: *Special Report on Area and Population.* Ottawa, 1912.

*Secondary Education (Scotland) Report for the Year* 1911. By Sir John Struthers, K.C.B., LL.D. *Price* 3*d.* London: His Majesty's Stationery Office, 1911.

*Agricultural Statistics*, 1910. Volume 45, Parts 1, 2, 3. London, 1911.

*Victorian Year-Book*, 1910-11. By A. M. Laughton, F.I.A., F.F.A., F.S.S. Thirty-first Issue. Melbourne, 1912.

*A System for the Transliteration of Persian, Afghan, and Arabian Words.* Second Edition. Calcutta: The General Staff, 1912.

*On the Physiography of North-Eastern Australia.* By Dr. J. V. Daneš. Pp. 18. Prague, 1911.

*The World of Matter and the World of Mind.* An Address delivered by the Right Hon. Sir G. Reid, G.C.M.G., K.C., D.C.L., to the Royal Scottish Geographical Society. Pp. 19. Edinburgh, 1912.

*Diplomatic and Consular Reports.*—Trade of Constantinople and District, 1910-11 (4835); Foreign Trade of Italy, 1910 (4836); Swedish Budget, 1913 (4837).

*Colonial Reports (Annual).*—Report for Straits Settlements, 1910 (709): Report for Basutoland, 1910-11 (710).

*Publishers forwarding books for review will greatly oblige by marking the* **price** *in clear figures, especially in the case of foreign books.*

## NEW MAPS.

### EUROPE.

**ORDNANCE SURVEY OF SCOTLAND.**—The following publications were issued from 1st to 29th February 1912 :—

One-inch Map (third edition), engraved, in outline. Sheets 83, 102, 110. Price 1s. 6d. each.

Six-inch and Larger Scale Maps.—Six-inch Maps (Revised). Quarter Sheets, with contours in blue. Price 1s. each. *Ayrshire.*—6 NE.; 8 SW.; 13 NE.; 20 SW. *Lanarkshire.*—42 SE.; 43 SE.; 46 NE.; 48 SW.

1 : 2500 Scale Maps (Revised), with houses stippled, and with areas. Price 3s. each. *Lanarkshire.*—Sheets XIII. 8; XXIII. 8, 12; XXIV. 5, 6, 9, 10.

Note.—There are no coloured editions of these Sheets, and the unrevised impressions have been withdrawn from sale.

The following publications were issued from 1st to 31st March 1912 :—

One-inch Map (third edition), engraved, in outline. Sheets 117, 121, 129. Price 1s. 6d. each.

Six-inch and Larger Scale Maps.—Six-inch Maps (Revised). Quarter Sheets, with contours in blue. Price 1s. each. *Ayrshire.*—19 NE. *Lanarkshire.*—32 SW.; 38 SW.; 46 NW. With contours in black. Price 1s. each. *Peebles-shire.*—7 NE.; 11 NE.; 15 SW.

1 : 2500 Scale Maps (Revised), with Houses stippled, and with Areas. Price 3s. each. *Lanarkshire.*—Sheets XIII. 16; XVIII. 6, 16; XIX. 9. Sheet IX*a*.—(5 & 1). Price 1s. 6d.

Note.—There are no coloured editions of these sheets, and the unrevised impressions have been withdrawn from sale.

Special Enlargements from 1 : 2500 to 1 : 1250 Scale. Prepared for the Land Valuation Department, Inland Revenue. Price 2s. 6d. each. *Ayrshire.*—Sheets VII. 8 NE., SE.; VIII. 6 NW., SW.; X. 8 SW.; XIII. 9 NW., SW.; XVIII. 5 NW.; XIX. 14 NW., SE., 15 NW., NE.; XXIII. 2 NE., 4 NE.; XXVII. 1 SE.; 10 SE., 14 SE., 15 NW.; XXIX. 10 SW.; XXXV. 11 NE.; LV. 4 NW. *Zetland.*—Sheets LIII. 13 NE., SE.

**ADMIRALTY CHARTS, SCOTLAND :—**

**Scotland, East Coast.** Sheet 4. Banff to Dunbeath Harbour. New edition, 1912. Number 1823. Price 3s.

**Scotland, North Coast.** Cape Wrath to Flannan Isles. New edition, 1912. Number 2386. Price 4s.

**Scotland, North-East Coasts.** South Sheet. New edition, 1912. Number 2397A. Price 3s.

**The North Sea.** Southern Sheet. New edition, 1912. Number 2182A. Price 4s.

**The North Sea.** Northern Sheet. New edition, 1912. Number 2182B. Price 4s.

**Loch Boisdale, Hebrides.** Published 1912. Number 618. Price 2s.

*Admiralty Office, London.*

**SCOTLAND.**—Bathy-orographical Map. Constructed and engraved by W. and A. K. Johnston, Limited. Scale 1 : 380,000 or 6 miles to an inch. Mounted on rollers and varnished. Price 12s.

*W. and A. K. Johnston, Limited, Edinburgh and London.*

This is the latest addition to Messrs. Johnston's Series of Orographical School Wall Maps. The height of land and depth of sea are effectively tinted according to contour lines. The names of the physical features are printed in black, and the principal railways and town names are in red.

**EDINBURGH.**—Bartholomew's Pocket Plan of Edinburgh and Suburbs. With index to streets and public buildings. Scale 3½ inches to a mile. Price 6d. in case, or 1s. mounted on cloth in case. 1912 Edition.

*John Bartholomew and Co., Edinburgh.*

**CENTRAL EUROPE.**—Stanford's Geological Map. Scale 1 : 6,336,000 or 100 miles to an inch. *Edward Stanford, London.*

**KARTE DES DEUTSCHEN REICHES.**—Massstabe 1 : 100,000. Bearbeitet von der Kartogr. Abt. der Kgl. Preussischen Landesaufnahme, den Topogr. Bureau des Kgl. Bayerischen und der Abt. für Landesaufnahme des Kgl. Sächsischen Generalstabes, sowie dem Topogr. Bureau des Kgl. Württembergischen Kriegsministeriums. *R. Eisenschmidt, Berlin.*

The publication of this map has extended over many years, and this is a cheap re-issue of 40 sheets (see p. 270).

## AMERICA.

**ONTARIO.**—Topographic Map. Scale 1 : 63,360 or 1 inch to a mile. Sheet 29, Long Point. Sheet 31, Port Burwell. (Department of Militia and Defence.) Price 2s. net.

*Geographical Section, General Staff, London.*

## AFRICA.

**KAMERUN.**—Karte in 20 Blätter und 4 Ansatzstücken im Massstabe von 1 : 300,000, bearbeitet von Max Moisel. Im Auftrage und mit Unterstützung des Reichs-Kolonialamts. 1912. Blatt E 4, Mbere; Blatt F 1, Ossidinge; Blatt F 3, Joko; Blatt F 4, Betare; Blatt G 1, Buea. Price M. 2 each sheet.

*Dietrich Reimer (Ernst Vohsen), Berlin.*

**NORTHERN NIGERIA.**—General Staff Map on Scale 1 : 250,000 or about 4 miles to an inch. Eight new sheets—Lau, Biu, Dura, Messau, Katsina Allah, Dekina, Yashikira, Dekala. 1912. Price 1s. 6d. each sheet.

*Geographical Section, General Staff, London.*

**OUADAI.**—Échelle de 1 : 1,000,000. Dressée par A. Meunier. 1911. Price Fr. 2. *Service Géographique des Colonies, Paris.*

**TIME CHART, WEST AFRICA.**—Carte des Fuseaux Horaires de l'Afrique Occidentale Française. Échelle 1 : 6,000,000. Price Fr. 1.

*Service Géographique des Colonies, Paris.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

## THE ESKIMOS OF DAVIS STRAITS IN 1656.

(From the French of Louis de Poincy.)

By David MacRitchie.

(*With Illustrations.*)

The following account is extracted from a quarto volume published at Rotterdam in 1658, under the title *Histoire Naturelle & Morale des Iles Antilles de l'Amérique*.[1] The author only signs his initials, "L. D. P.," and in a second edition (Rotterdam, 1681) he remains altogether anonymous; but "L. D. P." is now recognised as denoting a certain Louis de Poincy. It is somewhat extraordinary that such an excellent description of the Eskimos of Davis Straits should be found in a book relating to the West Indies, and the author himself frankly admits that it is a digression from his general theme. How it came about is explained by the author. The chapter (18) of which this account forms the main portion was intended to relate solely to the narwal or sea-unicorn, as is shown by its opening words: "We cannot conclude our

[1] De Poincy's account is of great interest to Scottish readers, as well as to all anthropologists, in view of the fact that the Eskimos described by him are essentially the same kind of people as the Finnmen seen in Orkney waters in the latter part of the seventeenth century, as reported by the Rev. James Wallace, minister of Kirkwall, and others (see *The Scottish Geographical Magazine* for March 1912, pp. 126-128). "These Finnmen," observes Wallace, "seem to be some of these people that dwell about the Fretum Davis, a full account of whom may be seen in the *Natural and Moral History of the Antilles*, chap. 18." By an odd reversal of nomenclature, Wallace's son and editor, James Wallace, M.D., F.R.S. Lond., speaks of De Poincy's description of the Davis Straits Eskimos as "a full account of these Finnmen." It is clear that the elder Wallace, at any rate, had read De Poincy's book, had seen the illustrations which are here reproduced, and had no doubt in his own mind that the Orkney Finnmen were of the same stock as the Eskimos of Davis Straits. (I have to thank the authorities of the Advocates' Library, Edinburgh, for the use of their copy of the edition of 1658.)

account of sea monsters more suitably than by describing a fish so remarkable and wonderful that it demands a special chapter. This is the sea-unicorn, sometimes found in these parts," *i.e.* the West Indies. Thereupon he devotes some four or five pages to a description of the narwal, illustrated by two woodcuts, of a pleasing and quaint character, one intended to represent a West Indian and the other an Arctic specimen of this animal. He then glides into his digression on the Eskimos in the manner now recorded :—

At the very time when we were taking from our cabinet this account [of the sea-unicorn or narwal], for the purpose of making it known to the public, a vessel of Flushing, commanded by Nicolas Tunes, in which Burgemeester Lampsen, now deputy of his province in the assembly of the States-General, Heer Biens, Heer Sandra, and other merchants of the same town were interested, having safely returned from Davis Straits, brought back from thence, among other rarities, some fine trophies of those unicorns of the Northern Ocean, of which we have just spoken. And as the account which we have received of this voyage may throw great light upon the matter here treated of, we believe that the interested reader will approve of our placing this new information before him, related with the fidelity which marks the original account.

The captain, from whom we have received this narrative, having set out from Zealand at the end of the spring of 1656, with the intention of discovering some new source of trade in those northern lands, arrived at the end of June in Davis Straits, whence having entered a river which begins at 64° 10′ N. lat., he sailed to the seventy-second degree, where the land about to be described is situated.

As soon as the natives, who were out fishing, observed the ship, they came towards it in order to reconnoitre, in their little skiffs, which are made to hold only one person, those in advance being followed by so many others that in a short time they formed an escort of seventy of these little vessels, who never quitted the foreign ship until the anchor was cast in the best anchorage, where they testified by their acclamations and by every sign of goodwill that could be expected from a nation so little civilised the great joy they felt at this happy arrival. These little vessels are so admirable, whether one considers the materials employed, the marvellous industry displayed in their construction, or the incomparable dexterity with which they are controlled, that they well deserve the first place in the descriptions furnished by this agreeable digression.

They are constructed of small, slender strips of wood, the greater part of which are split in two, like hoops. These pieces of wood are fastened together by strong cords of the intestines of fish [*boyaux de poissons*, but probably seal-gut], which gives them the form required. They are covered outside with skins of seals [*chiens de mer*, literally, but presumably intended for *veaux marins*], which are sewn together so closely, and are so carefully coated over the stitches with resin, that the water cannot penetrate at all.

These little boats are generally from fifteen to sixteen feet in length,

with about five feet of circumference at the broadest part, the middle. From the middle they contract towards either end, narrowing to a point; these extremities being tipped with white bone or pieces of narwal [tusk]. The deck is flat, and covered with skin like the rest, and the hull has the shape of the belly of a large fish, so that they are well fitted to glide over the water. They have only one aperture, which is exactly in the middle of the structure. This aperture has a rim or girth of whalebone all round it, and it is shaped to fit a man's body. When the savages who have invented this little vessel wish to make use of it for fishing or for paddling about, they thrust their legs and thighs into the aperture [or man-hole], and, seating themselves on the bottom of the canoe, they lace their outer shirt so tightly to the rim of the man-hole that they seem to be grafted to the canoe and to form a part of it.

Having considered the appearance and the material of these little vessels, let us turn to the equipment of the men who control them. When they wish to go on the sea, they cover their garments with an over-shirt,[1] which is only used for this purpose. This sea-coat is composed of several skins, without the pile, which are so well prepared and joined together that they seem to be a single piece. This garment covers them from the top of the head down to below the navel. It is coated all over with a blackish gum, insoluble in water, to which it is quite impervious.[2] The hood which covers the head fits so closely to the neck and forehead that only the face is uncovered. The sleeves are tied at the wrist, and the lower part of the over-shirt is also fastened to the rim of the man-hole of the canoe so carefully, and with so much skill, that the man's body thus covered is always dry in the midst of the waves, which, with all their efforts, can only wet his face and his hands.

Moreover, they have neither sails, mast, rudder, compass, anchor, nor any other of the articles of equipment which are essential to our ships. Nevertheless their owners undertake long voyages in these little vessels to which they seem to be stitched. They know the stars quite well, and they need no other guide during the night. The oars which they use widen out at each end in paddle shape, and in order to enable them to cut the waves more easily, and also that they may be more durable, they enrich them with white bone, covering the ends of the wood and also the edges of the paddles, these bone additions being pinned to the wood with horn pegs instead of iron nails. The middle part of the oar is also ornamented with bone, or with precious horn [narwal or walrus ivory], and consequently the oar, which they grip in the middle, does not slip in their hands. Further, they handle their double-bladed paddles with such dexterity and swiftness that their little

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[1] Known as *kâyarsît* in East Greenland and *kakorsorkut* in West Greenland at the present day. Both these names are clearly connected with the word *kayak*.

[2] It is curious to reflect that the mackintosh waterproof coat, which received its distinctive name from its supposed inventor in the nineteenth century, was actually in use among the Eskimos of Davis Straits in the seventeenth century.

vessels easily outdistance ships under full sail, with favourable wind and tide. They are so much at their ease in these little skiffs, and they manage them with such skill, that they make them perform a thousand caracoles for the amusement of spectators. Sometimes they tilt at the waves with such force and agility that they beat them into foam as though agitated by a storm, when they look more like struggling sea-monsters than like men. And as if to show that they have not the slightest fear, and that they are on the best of terms with this element which nourishes and caresses them, they turn lateral somersaults [*ils font le moulinet*], plunging and rolling in the sea as often as three consecutive times, in such a manner that they might pass for veritable amphibians.[1]

When they intend to make a longer voyage than usual, or when they fear they may be driven out into the open sea by a tempest, they carry in the interior of their canoe a bladder full of fresh water for quenching their thirst, and some frozen or sun-dried fish to sustain them, failing any fresh food. But it rarely happens that they require to have recourse to these provisions. For they have certain darts or small spears, attached to their canoes, which they know how to cast so swiftly at the fish [*poissons*; but marine animals are indicated] which they come across, that they are scarcely ever without fresh food. They have no need whatever of fire for cooking their viands, because, whether on sea or land, they are accustomed to eat their food quite raw. They carry also certain teeth of large fish [*i.e.* narwal and walrus tusks], or very sharp bone spits, which serve them as knives, for they use them to rip up and carve the fish [or marine animals] that they capture. There can be no altercation, moreover, in these vessels, because one single man is captain, seaman, purveyor, and pilot, who can stop the vessel when he thinks fit, or abandon it to the wind and tide, whenever he wishes to take the rest that he requires for recruiting his strength. In that event he thrusts his paddle into deerskin straps made for this purpose, which are attached to the deck of his canoe; or otherwise he fastens it to a buckle which hangs in front of his over-shirt.

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[1] This performance is described by the Rev. J. G. Wood in these words (*Natural History of Man*, London, 1870, p. 712):—"After seeing that the skin cover is firmly tied round his waist, and that his neck and wrists are well secured, the man suddenly flings himself violently to one side, thus capsizing the kia [otherwise kayak], and burying himself under water. With a powerful stroke of his paddle he turns himself and canoe completely over, and brings himself upright again. A skilful canoe-man will thus turn over and over some twenty times or so, almost as fast as the eye can follow him, and yet only his face will be in the least wet." It is a matter of regret that the Eskimos of Labrador have now quite lost this art (Hutton's *Among the Eskimos of Labrador*, London, 1912, p. 246), a presage of the time when the use of the kayak itself will be forgotten. E. W. Nelson also records the decay of this accomplishment among the Eskimos of Bering Straits in 1877-1881. "I was told," he says, "that some of the most skilful among the coast people could upset their kaiaks and right them again by the use of the paddle, but the old men said this feat was now becoming rare, as the young hunters were degenerating and were not as good kaiak men as formerly" (*Eighteenth Annual Report, Amer. Ethnology, Smithsonian Inst.*, 1896-97, Part I., p. 222).

The women never use these little skiffs,[1] but in order that they may sometimes amuse themselves on the sea, their husbands, who show them much gentleness and affection, convey them in other vessels, of the size of our long-boats, and capable of carrying fifty persons. They are made of sticks tied together, and are covered with seal-skins [*peaux de chiens de mer*], like those we have just described. They are propelled by oars in calm weather, but, when the wind serves, sails of skin are hoisted to the mast.

In order that the description of these rare vessels, and of these

men of the sea, may be made clearer and more lifelike, we have here introduced a representation of them, taken from the life.

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[1] The testimony of most writers on the Eskimos is to the same effect. On the other hand, it is stated by Baffin, who was pilot of the *Patience*, one of Captain Hall's ships in 1612, with reference to the Greenland natives: "Every one, both man and woman, has a boat covered with seal's skin, close sewed, that no water can enter them" (Hakluyt Society's Arctic vols., London, 1894, pp. 100-101). The Danish expedition of 1883-85 found also that two women at Angmagsalik possessed kayaks (*Meddelelser om Grønland*, x., Copenhagen, 1888, p. 384 of text). Among the Eskimos of the western shores of Hudson's Bay, women still use kayaks, but in a very restricted fashion. Speaking of the people of that region and their kayaks, Mr. David T. Hanbury observes:—"They do not trust their women in them unless they are lashed together so as to form a raft" (*Sport and Travel in the Northland of Canada*, London, 1904, p. 3). According to J. G. Whittier, the use of the kayak was quite common among the women of the Eskimo tribes formerly inhabiting the northern coast of the St. Lawrence at its embouchure, as may be seen from his reference to the

"Squaw, in her small kyack,
Crossing the spectre's track."

Another illustration is afforded by the woman in the two-holed kayak reported by Martinière as captured off the Vaigatz coast in 1653. All these show that the kayak was not exclusively a man's canoe, although its use by women has been very exceptional in recent times.

With regard to the native land of these people, its situation, already indicated, denotes that the climate is very cold. It is true that during the months of June and July, which constitute the summer of that country, and which are lighted by a perpetual day—just as the months of December and January are one long night—the air is warm, agreeable, and serene; but during the rest of the year, as the days lengthen and contract alternately, there are dense fogs, snow, and hail, with great cold.

All the seaboard territory is dry, and rough with bare rocks, of a frightful aspect; while, when the snows are melting, it is flooded in many places with torrents rolling their troubled waters into the vast bosom of the sea. But, after traversing about a league of barren country, one comes to beautiful fields, carpeted in summer-time with a pleasing verdure. There also one sees mountains covered with small trees, which enliven the view wonderfully, and give shelter to birds and water-fowl. And one passes by valleys watered by clear and pleasant streams, flowing downward to the sea.

The captain who commanded this Flushing vessel, in the voyage now chronicled, having landed with a party of his people, and having surveyed the neighbourhood carefully, observed among other things worthy of remark a vein of a certain brown earth, studded with glistening silvery particles, of which he caused a cask to be filled for assay, but after having been tested in the crucible, it was found to be only fit for using as an encrustation on small boxes and similar woodwork, to which it gave a very beautiful lustre. Nevertheless, this indication leaves some hope that one might find mines of silver in this earth, by penetrating further.[1]

Although this country is very cold, one sees there several beautiful and large birds, of black and white plumage and of various other colours, which the natives flay for the purpose of making themselves garments of the skins, the flesh of those birds being of course eaten. Deer, elk, bears, foxes, hares, rabbits and many other quadrupeds are found there; nearly all of which have white or grey fur, very thick, long, and soft, and very suitable for making good caps, or beautiful and rich garments.

As regards the inhabitants, our travellers report having seen two kinds, who live together on the most friendly terms. Of these, one kind is described as very tall, well-built, of rather fair complexion, and very swift of foot. The others are very much smaller, of an olive complexion, and tolerably well proportioned, except that their legs are short and thick. The former kind delight in hunting, for which they are suited by their agility and natural disposition, whereas the latter occupy themselves in fishing. All of them have very white, compact teeth, black hair, animated eyes, and the features of the face so well made that they present no notable deformity. Moreover, they are all so vigorous and of such a strong constitution, that several of them who have passed their hundredth year are still lively and robust.[2]

[1] I am informed by Mr. W. F. P. M'Lintock, B.Sc., of the Royal Scottish Museum, that the substance in question is probably mica.

[2] The statement that these people represented two different types is of much interest. The small, olive-complexioned, short-legged people are at once recognisable as Eskimos.

In their ordinary conversation they are of a gay humour, and cheerful and brave. They like their foreign visitors because they bring them needles, fish-hooks, knives, bill-hooks, hatchets, and all other iron implements that are useful to them; and they prize these so highly that they buy them at the cost of their own clothes and of all that they value most. They are, however, so opposed to all novelty in dress and diet that it would be very difficult to persuade them to alter the one or the other. Although they are one of the poorest and most barbarous nations that the sun shines upon, they regard themselves as very fortunate and as having the happiest lot in the world. Indeed, such a good opinion have they of their way of living that the civilities of all other nations seem to them as barbarous, unbecoming, and as ridiculous as possible.

The high estimate which they have placed upon their condition contributes not a little to that satisfaction and contentment of mind which is seen on their faces. Add to this that they do not concern themselves with various affairs that might trouble their tranquillity. They do not know all those gnawing cares and worries with which the restless desire for riches vexes most other men. The luxury of beautiful and sumptuous buildings, the spirit of the times, the delights of grand entertainments, the knowledge of things that are beautiful, and all that we esteem as tending to the charm and tranquillity of life, having never yet reached them, they are not vexed by any desire of possessing these things, which might disturb the peaceful life they now enjoy. Their sole aim is to acquire without much trouble those things which are essential for their food and clothing.

Their usual exercises are hunting and fishing: and as they have neither fire-arms nor nets, necessity has taught them to attain success by other methods. They eat all their viands raw, and without any other sauce than a hearty appetite supplies. They laugh at those who cook fish or venison, for they assert that fire absorbs their natural flavour and everything that gives them savour, according to their taste.

But although they have no need of fire for cooking their food, they nevertheless appreciate its usefulness very highly, and their caverns are never without fire during winter, as much for the sake of brightening and cheering the gloomy darkness of the long night that reigns in their country, as for modifying by its pleasant warmth the cold which besets them. But when they sleep, or when they need to come out of their grottoes, they fortify themselves with a certain fur which, by an admirable instance of Divine Providence, has the virtue of protecting them against all injury by frost when they are reposing in the midst of the snows.

The men's attire consists of a shirt, breeches, coat, and boots. The shirt comes down to a little below the loins: it has a hood which covers

But their taller and fairer comrades give rise to speculation. The readiest suggestion is that they were descended from the early Norse settlers. It is believed by many that the Norsemen were not exterminated by the Eskimos, but were gradually absorbed by them, through successive intermarriages. (See, for example, Dr. Nansen in *In Northern Mists*, London, 1911, vol. ii. p. 103.) The account given by Tunes seems to show that this was the case, but that the fusion of the two races was still only partial in 1656.

the head and neck. It is made of the bladders[1] of large fish, which are cut into strips of equal breadth and are very closely stitched together. There is no opening at the chest as in our shirts, but in order that it may not tear when one is putting it on, the ends of the sleeves [*la fâche* (?)] are bound beneath with black leather: as in the figure here shown.

Their other clothes, and even their boots, are also made similarly to their shirts: but they are of much stronger material, namely, of dressed deerskin or sealskin [*peau de chien de mer*], with the pile retained. The garb of the savage whose portrait is here reproduced, drawn from life, was of two skins of different shades, the strips being cut of one breadth, and so tastefully arranged that one white strip was sewn between two brown, with a fine effect. The pile seemed to be as soft and smooth as velvet, and was so well laid, and the various parts were so skilfully joined together that the general effect was that of a garment made of one single skin. As regards the form of the hood, and all the externals of the savage whom they adorned, the engraver has shown them so clearly in this picture that it would be superfluous to attempt a fuller description.

The savages inhabiting the Davis Straits region never go into the

[1] *Vessies de gros poissons.*—the intestines of seals, no doubt, as in similar waterproof shirts in use to-day.

country without having a quiver filled with arrows on their shoulder, and a bow or spear in their hand. The arrows are of various kinds. Some are suitable for killing hares, foxes, birds, and other small game; while those of a different variety are used in the pursuit of deer, elk, bear, and the larger animals generally. The former are only about two or three feet long, and, instead of iron, are pointed with bone, very sharp, and having three or four barbs on one side, which have this effect that the arrow cannot be withdrawn from the place which it has pierced without enlarging the wound. The latter are at least four or five feet long, and are tipped with bone, with serrated barbs. These latter are

launched with the hand, but in order to give them greater force and so send them farther, they hold in their right hand a throwing-stick, grooved on one side, in which they place the butt-end of the javelin, to which a great impetus is thus conveyed when it is launched.

Sometimes, also, they carry a kind of lance in the hand, furnished at the small end with a round bone, the point of which has been sharpened on a stone, or with the horns or tusks of the fish already described [narwals and walruses]. These lances are seven or eight feet long, and they are furnished at the butt end with two pinions of wood or of baleen, by which they are better balanced in their flight.

Besides several kinds of fish-hooks which they use for catching the smaller fish along their coasts, they have also various sorts of darts [harpoons] which they launch with unparalleled dexterity at the great

and monstrous fish [*i.e.* marine animals] that they seek in the open sea. And in order that their prey, when wounded with these darts, may not sink to the bottom of the sea and thus frustrate their efforts, they fasten a deerskin tether, twenty-five or thirty fathoms long, to the butt end of the harpoon, while to the other end of the tether or line is attached an inflated bladder, which, always coming up to the surface of the water, denotes the place where the fish [animal] is, and thus they are enabled to draw it towards them, or to guide it to the shore, after it has exhausted its strength.

The dress of the young women is not very different from that of the men; but the old women more often clothe themselves with the skins of certain large birds, of black and white plumage, which are very common in that region. They are so skilful in flaying these birds that the feathers remain attached to the skin. These garments hang down to the calf of the leg. They are girdled with a leather belt, to which, in place of keys, they hang several small implements of bone, pointed like pins, of the length of a bodkin. They wear neither bracelets, nor necklaces, nor ear-rings; but, as their only embellishment, they make an incision in each cheek, and then fill the cicatrix with a certain black colour which, in their opinion, makes them seem much more charming.

While the men are away hunting or fishing, they busy themselves in sewing garments, and in making tents, baskets, and all the little utensils required for their domestic life. They also take great care of the young children, and when they have to change their abode, or to follow their husbands on some journey, they carry or lead the children wherever they go, and in order to amuse them by the way and to soothe them when they cry, they have small drums, covered with fish-bladder, upon which they know how to play such pleasant tunes that the Basque tambourines are not more agreeable. They also beat upon these drums for the purpose of frightening away bears and other wild beasts that often prowl around the caverns in which these savages and their families live during winter, or around their tents in summer.[1] We insert here the portrait of one of these women, clad in feather garments, whence the graceful appearance of the others may be inferred.

Although these poor barbarians have not much in the shape of civil government, they have nevertheless among them petty kings and chiefs who rule over them, and who preside in all their assemblies. They raise to these dignities those who have the best physique, and who are the best hunters and the bravest among them. These rulers wear more beautiful skins and more valuable furs than their subjects, and as a badge of their rank they wear an embroidered rosette stitched in front of their outer shirt, and when they go about they are always escorted

[1] No mention is made of the important part that the drum plays in the shamanistic rites of the Arctic races of America, Asia, and (until recently) Europe. The drum held by the woman in the accompanying picture closely resembles that in use among the existing Inik, or Tâk, of Angmagsalik, East Greenland. See *Meddelelser om Grönland*, x., Copenhagen, 1888, Plate XXVI.

by several young men, armed with bows and arrows, who obey all their orders.

They do not possess the art of building houses: but during summer they live in the open country in skin tents, which they carry about with them and pitch wherever they find a good camping-place: and during winter they inhabit caverns, either those of natural origin in the mountains, or others which they have there dug out artificially.

They neither sow nor gather any kind of grain for their sustenance. Nor have they any fruit-bearing trees or plants, except a few strawberries and a species of raspberry; but, as already indicated, they subsist

entirely by hunting and fishing. Their ordinary drink is pure water, and their most delicious draught is the blood of seals, or of deer and other land animals that they have slain, or that they have caught in the traps which they know how to set with marvellous skill.

The winter of their country being so long and so rigorous, they suffer much want during that dismal season, especially throughout that terrible night that enwraps them for two whole months; but, besides the fact that they are well able to endure hunger, if need be, they have so much foresight that they cure the surplus of their fish and other viands in summer, and store it up, with all the fat and tallow that they can collect, for their sustenance in that trying and wearisome season. It is said, moreover, that they are so skilful in hunting by moon-

light that during the thickest darkness they are seldom without fresh meat.

They have no desire to see any other country than that of their birth; and should it happen that some violent tempest, or some other circumstance, may have driven them to a foreign country, they are always sighing for their dear fatherland, to which they unceasingly demand to be restored. If their request be not granted, they then try, at the risk of their lives, to make their way thither in their little vessels, in which they expose themselves to all the perils of the deep, without any other guide than that of the stars, of which they have sufficient knowledge to enable them to steer their course.[1]

Their language has nothing in common with that of any other people in the world. We have a small vocabulary of it: but, for fear of lengthening this digression excessively, we shall retain it among our papers, until a second voyage which is projected for Davis Straits may give us fuller light on the subject.

The religion in use among these poor barbarians has not yet been properly noted; but as they often regard the sun with admiration, expressed by their uplifted arms, it has been inferred that they believe it to be God.

The ship which has furnished us with this account returned from Davis Straits laden with much good merchandise, a list of which we give here in order to show that the cold which reigns in that country is not so rigorous as to freeze all sorts of commerce.

1. Nine hundred sealskins, the majority being from seven to eight feet long, chequered and wavy with black, russet, yellow, tan, and several other colours, which raise their price above those one commonly sees in Holland.

2. Several rich skins of deer, elk, bear, fox, hare, and rabbit, the most of which were quite white.

3. A great many precious furs of various four-footed animals, special to that region, at present unknown among us by name.

4. Several bundles of whalebone, of extraordinary length.

5. Some complete suits of the garments worn by the natives, made of the skins of animals and birds, as shown in the illustrations.

6. Several of their shirts made of the bladders of fishes [? intestines

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[1] There is some reason to suspect, from the above paragraph, especially when taken in connection with the subsequent reference to sun-worship, that De Poincy had embellished his account with certain details obtained from De La Peyrère's *Relation du Groënland* (Paris, 1647, 1651). In that work it is stated, with regard to several Eskimos of Davis Straits who had been brought captive to Denmark in the early years of the seventeenth century:—"Some people who had taken particular notice of their actions did observe them frequently lifting up their eyes towards heaven, and to worship the rising sun." Again, it is said of one of these captives who made his escape from Copenhagen in his kayak, but was recaptured at sea:—"Being given to understand by certain signs that he must have been infallibly swallowed up by the waves of the sea before he could reach the Greenland shore, he answered by signs that his intention was to keep along the coast of Norway, to a certain light, from whence he would have crossed over to Greenland, by the direction of the stars." De La Peyrère mentions also the painful longing for home with which these unhappy captives were afflicted.

of seals], strongly stitched together, and of their caps, gloves, and boots; also several specimens of their quivers, arrows, bows, and other weapons. Also several of their tents, sacks, baskets, and other domestic utensils.

7. A large number of those little sea-going vessels constructed to carry only one man. A large boat forty-five feet in length, capable of carrying fifty persons comfortably.

8. But the rarest and most precious of all this freight was a very considerable quantity of those tusks or horns of the fish called *sea-unicorns* [narwals], which are pronounced to be larger, finer, and better proportioned than any yet seen.

Some of these horns have been sent to Paris, and some to other parts of Europe, where they have been received with appreciation: but there is every probability that they will be still more highly prized when their admirable medical properties become known. For although their beauty and their rarity ought to place them highest among the most precious treasures of the finest collections, several celebrated doctors and apothecaries of Denmark and Germany, who have tested them in various cases, are firmly of opinion that they are antidotes to poison, and that they have all the properties commonly attributed to the horn of the land-unicorn.[1]

But enough has now been said for a simple digression; probably more than enough to suit the taste of some readers.

De Poincy's account contains many interesting items. The illustrations are of special value, as they are the work of a good artist, although his picture of a kayak is very faulty. The dress of the natives seems to have been reproduced by him with great care and precision. It will be noted that several complete suits were brought home to Flushing, along with various Eskimo implements. Not the least remarkable detail is the number of kayaks,—sufficient to enrich many of the museums of Western Europe. At this period, indeed, there must have been a considerable number of such trophies in public and private collections. Only three years previously a Danish ship had brought a two-holed kayak to Copenhagen, together with several of the kayak-people themselves, clad in the skins of animals and birds, all obtained on the north-eastern shores of Russia.[2] Two narwal horns also formed part of the spoil brought home from Russia. From De La Peyrère's account (1647) we learn that Copenhagen already possessed a number of kayaks, which, with their owners, had been brought from Davis Straits earlier in the century. It is curious to note the air of novelty which each narration seems to give to those Arctic trophies. In our days of close inter-

[1] Even as recently as the eighteenth century unicorn's horn was believed to possess curative properties. Mrs. Henry Cust informs us that at that period "the popular *poudre de M. Daquin* contained ounces of elk's hoof and unicorn's horn in strange proximity with ounces of 'the root of a male peony gathered at the wane of the moon,' and of 'the rakings of the skull of a man dead of a violent death.'" (See Mrs. Cust's *Gentlemen Errant*, London, 1909, pp. 402-3.)

[2] See the *Scottish Geographical Magazine*, August 1909, pp. 399-403.

communication by means of steam, electricity, and printing, it is difficult to realise how comparatively isolated people were in the seventeenth century, and how each returning voyager thought he was bringing home something new, when, as a matter of fact, his supposed novelties were well enough known. The skin-canoes encountered off Vaigatz by the Danish expedition of 1653 were manifestly of the same kind as those spoken of by Stephen Burrough in 1556. It is not unlikely that Burrough and his comrades had brought back some of these canoes to England, although the circumstance may not be recorded. Recorded instances of captured kayaks are very numerous. Those preserved in Edinburgh, Aberdeen, and Orkney in the seventeenth century,—all of them obtained in Scottish waters,—have already been noticed in the *Scottish Geographical Magazine*.[1]

Besides these, many other instances are chronicled. The earliest seems to be that referred to by Claudius Claussön Swart, a native of Funen, Denmark, who is better known as Claudius Clavus, and sometimes as Nicolaus Niger. He tells us how the Wild Lapps inhabit the north of Norway, and how to the west of them is a dwarf race, individuals of whom, he asserts, "I have seen after they were taken at sea in a little skin-boat which is now [*circa* 1430] hanging in the cathedral at Nidaros," *i.e.* Trondhjem. These appear to be the same people as the "Skraelings" described by Michael Beheim, who travelled in Norway in 1450, and who states that these "Skraelings" lived in artificially-made caverns, constructed skin-vessels, ate raw meat and raw fish, and drank blood. Seventy years later, Archbishop Erik Walkendorf speaks of a dwarfish race of "Skraelings" who lived to the north-north-west of Finmark. He states that they dwelt in underground houses, and that they were "an unwarlike people, for fifteen of them do not dare to approach one Christian or Russian" (an odd differentiation). With these statements may be compared the remains of troglodytic dwellings still to be seen on the southern coast of the Varanger Fiord, and the harpoon-points found there (at Kjelmö), resembling, according to Dr. Nansen, "old, primitive Eskimo forms, which are found in Greenland." "All the harpoons found at Kjelmö are remarkably small, and cannot have been used for any animal larger than a seal," observes Dr. Nansen,[2] and he adds, "Nothing has been found which might afford us information as to the kind of boats these northern sealers used." But, in view of the statements made by Claussön and Beheim in 1430 and 1450, it is not unreasonable to suppose that the vessels used were skin canoes.

These conjectures, however, interesting although they are, form as much a digression from De Poincy's account of the Davis Straits Eskimos as that account forms a digression from his *Natural and Moral History of the Antilles*; and, in his words, "en voila assés, & peutestre que trop au goût de quelques-uns, pour une simple digression."

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[1] March 1912.

[2] For these early Norwegian references I am indebted to Dr. Nansen's *In Northern Mists* (London, 1911), vol. i. pp. 215-217, and vol. ii. pp. 85-86 and 269-270.

# THE MAKING OF SCOTLAND: AN ESSAY IN HISTORICAL GEOGRAPHY.

By W. R. Kermack, B.A.

"Two things are vital in the history of every people, its ethnic composition and the wars it wages in defence or extension of its boundaries."[1] In these words may be summed up the early development of any nation, above all of such a nation as Scotland, whose very name is taken from an immigrant race, and whose destinies are to so great an extent bound up geographically with the richer southern portion of the island. For it is upon the ethnic qualities already present in a people that there must work all the forces, products of physiological and climatic conditions, which together shape mysteriously a nation's individuality. And these forces can only work effectively, or indeed can only work at all, where such boundaries exist as include within themselves an entity of geographic conditions, to whose influence the inhabitants may be subjected, and at the same time afford the national individuality opportunity for undisturbed development. The sources of Scottish nationality are to be found, first, in a basis of racial elements different in composition from that of the English people: second, in the prevalence for centuries previous to the Tudor epoch of geographical conditions, which emphasised the peninsular aspect of Scotland in respect to England, rather than the location of the island as a whole in regard to the Continent. The conditions which made generally apparent the geographical unity of Great Britain were not in existence when the first Edward purposed to marry his heir to the Maid of Norway: they were hardly present even at the time of Somerset's "English wooing": and it was indeed only their common adoption of Protestantism, and their common danger from the power and ambitions of Spain, combined with the historical accident of James's claim to the English throne, that brought to Englishmen and Scotsmen a conviction of their community of interests, and a willingness to attempt to realise, in some degree at any rate, the common nationality made possible for them by the Tudor navy's command of the narrow seas.

Geographical unity is not, it is true, dependent upon identity of geological structure, but while this is so it is important to remember that essential contrast between the south-east plain and the north-west oceanic border of Britain, which, founded on a fundamental difference in rock structure, has found expression in resultant differences, agricultural, industrial, racial, and historical, drawing north-west and south-east to some extent apart, to participation in different destinies.[2] Scotland, Wales, the Pennines, the Lake District, Devon and Cornwall, are all composed of older and harder rocks than the south-east of England:

[1] E. C. Semple, *Influences of Geographic Environment*, 1911, p. 75.

[2] This contrast forms the main argument of H. J. Mackinder's famous book. *Britain and the British Seas.*

they have, as a consequence, resisted denudation, while the more recent and softer deposits have been eroded into the English plain. In this contrast there was inherent from the first the probability that there would be established rival states in Britain, representative of the plain and of the highlands. Within the bounds of Scotland itself, however, there are also important, though lesser, structural differences, which have deeply influenced its history. The country falls into three main divisions, the Highlands, formed of hard and ancient rocks, poor in soil, and deluged with the rain brought by south-west winds from the Atlantic; the Southern Uplands, the hills of that Scottish Border-land so rich in history and romance, formed of rocks of Ordovician and Silurian age, and extending south-westward from the North Sea near Dunbar to the Rhinns of Galloway; and between them the Midland Valley of Scotland, where the rock-floor, contemporary with the surface rocks of the Highlands and Southern Uplands, has been let down along two nearly parallel lines of faulting running north-east and south-west across Scotland, and covered with more recent rocks of Old Red and Carboniferous age. It was in this Midland Valley, richer in soil, and more open to commerce than the mountains which guarded it to north and south, that the distinctive national life of Scotland could find room to develop. From it, however, the Border Uplands, intersected by the broad valleys of the Nith and Tweed, were comparatively accessible; and it was only the Highlands which remained really out of touch with the progress in civilisation made by the country as a whole. On the other hand, if the Highlands were closed to the entrance of influences from the south, they were open to the western seas; and early Scottish history is in great part the record of the strife of rival civilisations, entering on the one side from Ireland through the western Highlands, and extending on the other on all the shores of the partially-enclosed German Ocean or North Sea. The Middle Ages saw the spread of a common culture on all these coasts from Bruges to Bergen through the agency of commerce[1]; while yet later western influences, in a new and vaster form, again prevailed, when men turned their ambitions westwards across the Atlantic, towards the New World.

With this contrast between west and east is connected the question, a most difficult and controversial one, of the racial basis of Scottish nationality. Owing perhaps to climatic conditions, which rendered life impossible, there is no record that Scotland was inhabited by Palaeolithic man. In Ireland and the west of Great Britain generally, however, extending up the western coasts of Scotland as far north as the Orkneys and Shetlands, are found the long barrows and the finely-polished stone implements of a Neolithic population, long-skulled, brunette in colouring, of medium stature, types of the race now generally known as Mediterranean.[2] With these Neolithic settlers, it seems, may be identified the people known to us in history as the Picts, so far as that term has

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[1] Ellen Churchill Semple, *Influences of Geographic Environment*, p. 304.

[2] See generally H. J. Mackinder, *Britain and the British Seas*, chap. xii.; M. I. Newbigin, *Modern Geography*, pp. 202-7.

racial significance, and is not used, as apparently it is by Roman and British writers, to denote generally the barbarous tribes beyond the frontier who practised the custom of tattooing.[1] The absence of Neolithic remains from the eastern side of the island suggests that the new-comers found in the moister climate of the west conditions more comparable to the regions from which they came. The long-headed invaders were not left in undisturbed possession of their conquests, for beside their long barrows or cairns there are also found in the Clyde Valley and elsewhere in southern Scotland, and in the English plain, the round barrows of a round-headed race, users of bronze weapons and implements, and obviously on a higher plane of civilisation than the Neolithic population. This people, by the shape of their skulls, is marked as belonging to the second great race found in Europe, called Alpine, or Eurasiatic, more stoutly built, and with hair and eyes considerably lighter in colour than those of Mediterranean man. Historically we have knowledge of only two, possibly of three,[2] of the great waves of invasion in which Alpine man reached Britain from the south-east, of which the first, of Goidelic or Gaelic Celts, arriving about B.C. 600,[3] penetrated to the western shores of Scotland, overcame the resistance of the native population, probably through their use of better weapons, and imposed upon them their superior civilisation. The Picts to some extent adopted the language of their conquerors; the Goidels, on the other hand, seem to have taken as their own the religion—Druidism—which they found native to the soil.[4] In their turn the Goidels were followed by a second body of Celtic immigrants, known to us as Brythons or Britons, possibly users of iron weapons. Once again the new-comers seized upon the fertile lands of the English plain, but they did not penetrate much further northward than the Firths of Forth and Clyde, where the Romans found them as the great confederacy of the Brigantes between the Humber and Mersey and the Caledonian Forest.[5] Their hold upon southern Scotland, however, cannot have been a very firm one, for at the time of Ninian's mission at Whithorn, in the closing years of the Roman occupation of Britain, Pictish territory seems to have been continuous from the Solway to the Forth[6]; and it was only under pressure from the English invaders that the Britons finally established their hold upon Strathclyde, transferring the centre of their kingdom from Carlisle to Alcluyd (Dumbarton) in 573, after the battle of Ardderyd, and thus driving a wedge between Pictish territory in Galloway and on the shores of the Forth. The battle-cry, "Albani,"

[1] C. Oman, *England before the Norman Conquest*, page 25: compare Claudian, xxii. 253:—

> Venit et extremis legio praetenta Britannis
> Quae Scoto dat fraena truci, ferroque notatas
> Perlegit exsangues Picto moriente figuras.

[2] The Belgae, newly arrived in Southern Britain in the time of Caesar, may have been either a third body of Celtic invaders or the last of the Brythonic Wave.

[3] C. Oman, *England before the Conquest*.

[4] J. Rhys, *Celtic Britain*, pp. 69, 73.

[5] *Ibid.* pp. 221, 223.

[6] A. O. Anderson, *Scottish Annals from English Chroniclers*, preface, and p. 7.

of the Galwegians at Northallerton, moreover; their apparent connection on several occasions with the Earls of Strathearn, and the reference of English writers to them as "Scots" or "men of Lothian," all tend to show that no special racial distinction was recognised in the twelfth century as marking off the inhabitants of Galloway from their countrymen north of the Forth.[1] Indeed, it is an inevitable conclusion from the general absence in Britain of any considerable broad-skulled portion of the population, and from the presence of many non-Aryan peculiarities of syntax in all the Celtic languages, either that the actual numbers of the Celtic invaders were relatively small,[2] or that, less suited than the native population to their new environment, they were gradually absorbed by them, until the Mediterranean racial element once again became dominant.[3] The Goidels in Scotland and their Neolithic predecessors may thus most conveniently be comprised in the common designation of Picts; and both Celtic and non-Celtic peoples seem to have been included in the southern Pictish kingdom, south of the Mounth. The Caledonians of Tacitus, more stoutly built and with fairer hair than the other northern tribes with which the Romans had come in contact, were probably a purely Celtic settlement in Athol and Strath Tay, rather than an advance-guard of the Teutonic-speaking raiders of post-Roman date.[4]

If the foregoing be in the main an accurate representation of the facts in a matter most controversial, it follows that, at the close of the fifth century, Scotland was peopled mainly by the descendants of her Neolithic invaders of Mediterranean type, though there were present also elements, uncertain in proportion, of Goidelic, and, in the district south of the Caledonian Forest between Loch Lomond and Dunkeld, of Brythonic-Celtic stock. These immigrants had probably all reached the country overland from the south, but the seas which, to east, north, and west, form its natural boundaries, and which have in other ways so profoundly influenced the national life, now, in the sixth century, brought in on the west and east new influences, destined to be most powerful in shaping Scotland's destinies.

The great eroded table-land of the Scottish Highlands has a continuation across the Irish Sea in the peninsula of Donegal, whose rocks are of the same character, and whose ridges trend in the same south-westerly direction. The structure and direction of the Mourne mountains in county Down show them to be similarly a continuation of the Scottish Southern Uplands. But the connection is more than geological; there stretch out from Scotland, like a bridge between the two countries, the peninsula of Kintyre and the island chain of Jura and Islay, so nearly reaching across that the Mull of Kintyre is distant only thirteen miles from Fair

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[1] Anderson, *Scottish Annals*, preface, pp. 198-9, 202-3, 241.

[2] Oman (*England before the Norman Conquest*, p. 17) suggests that in their progress across Europe the Celts absorbed some of the conquered tribes of Mediterranean type. It is well known, too, that in such great racial movements peoples of varied race often take part. Semple, *Geographic Environment*, p. 85.

[3] Rhys, *Celtic Britain*, chap. vii.; Mackinder, *Britain and the British Seas*, pp. 183-4.

[4] *Ibid.* p. 186; Rhys, *Celtic Britain*, pp. 164-5.

Head in Antrim. The coastlines both of western Scotland and of Down and southern Antrim are fretted into bays and fiords such as formed the nursery of the Vikings: and such coasts are bound together rather than separated by salt water, if either coast is inhabited by a people apt to the sea. Such a people, it seems, in the early dawn of British history, dwelt in Uladh, eastern Ulster, in the modern counties of Down and Antrim. Who they were, racially, remains uncertain, but Professor Rhys conjectures that both tribes in this district, the Dal Riada and the Dal Araidhe, were of non-Celtic origin, representatives of the early inhabitants of Ireland, of Mediterranean stock, who had been driven (according to the Four Masters, in 327) east of Lough Neagh and the Bann by the encroachment of the Goidelic Celts in Ulster.[1] With these they still remained at war; and it was the pressure of their more powerful alien neighbours, aided perhaps by the results of famine at home, which drove the "Scoti" (either the "tattooed," and therefore, in Roman estimation, less civilised, tribes of eastern Ulster, or the "broken men,") to join about 360 with the Picts of Galloway, probably also non-Celtic, and thus, racially, kinsmen of their own, in their attacks on the Roman province of Britain. It was probably not long after, possibly during the rule in Ireland of Niall "of the nine hostages" (379-405), who was constantly engaged in piratical enterprise on the coasts of Britain, that these Scots of Dalriada made their first settlements in modern Scotland in Islay and Kintyre, though the first settlement definitely recorded dates a full century later.[2]

It is not quite certain what the conditions were which allowed this establishment of the Scots in the new Dalriada. According to Ptolemy, the sea-board of western Scotland from Dumbarton to Loch Eil was held by a people called the Epidii: their territory apparently included Kintyre, and possibly the islands from Arran to Tiree.[3] If, as is most probable, these were racially non-Celtic like the Scots of Antrim, the Irish colonists in Argyllshire may have come at the invitation of kinsmen and allies.[4] But the nature of the district in which they settled in itself supplies a sufficient reason for their success.

Geographically and historically Argyll stands somewhat apart from the main stream of Scottish life, while its lot has always been closely associated with a power in command of the sea. Its coastline throughout is deeply penetrated by the sea lochs which give to its scenery so much of its characteristic grandeur and charm, and no point of the district, it has been calculated, is distant more than twelve miles from salt water. At the same time, it is defined to landward by natural

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[1] Rhys, *Celtic Britain*, pp. 246, 270; *Hist. Atlas of Modern Europe*, Plate xxix., notes by G. H. Orpen.

[2] It is at least a curious coincidence that this movement of the Scots from Ireland should be generally contemporaneous with the greater movements on the continent of Europe. Fergus Mor, first ruler of Scottish Dalriada, became king in 502.

[3] Rhys, *Celtic Britain*, p. 225.

[4] Bede (*Hist. Ecclesiastica*) states that the Scots "advanced from Ireland, and claimed for themselves, whether by *friendship* or by the sword, the settlements which they have still."—Anderson, *Scottish Annals*, p. 4.

barriers which serve at once as a protection and as a serious obstacle to eastward expansion. The general line of the water-parting of the Highlands, crossing the Great Glen between Loch Lochy and Loch Oich, sweeps round the head of the Spey valley to the hills above the head of Loch Laggan, and then, turning westward, passes west of Rannoch Moor by Ben Douran and the hills above Glen Lyon to Crianlarich and to Ben Lomond. It was this water-parting that formed the landward boundary of Dalriada, though it is uncertain whether to it, or, more generally, to the central mass of the Highlands, the term Drum Alban was applied. Such a country fell, later, an easy prey to the Scandinavian Vikings; there Somerled long maintained a virtual independence of the rulers of Scotland; the galleys of John of Lorn were ranged against the national cause in the days of the Bruce: and the fortunes of Clan Campbell testify in history to its independent position, as their coat of arms bears witness to-day to the maritime connection of Argyll. The same conditions, it may safely be conjectured, allowed the pirates from across the Irish sea to make good their footing in Dalriada.

The result of their settlement seemed at first only the addition of another to the tribal kingdoms that disputed the territory of modern Scotland; but in or about 563 Columba sailed from Ireland and landed with twelve companions at Iona, establishing his mission-station just "where the sea-way from Ireland divides northward into the Minch and north-eastward into Glenmore."[1] A map, such as that by Gregory Smith in Poole's *Historical Atlas of Modern Europe*,[2] shows clearly the spread of Celtic Christianity into Pictland along these two natural lines, up the Minch by Tiree, Eigg, and Canna to Skye and Applecross, and by way of Lismore and the Great Glen to Rosemarkie in the Black Isle, and along the coastal plain of Nairn and Elgin to Mortlach in Strath Spey, Forglen on the Deveron, and Aberdour, Deer, and Turriff in Buchan. It suggests, too, how Christianity spread in a direction perhaps yet more important, through the only practicable opening in the hill barrier of Drum Alban at Tyndrum and Crianlarich (the route traversed to-day both by the West Highland and by the Callander and Oban Railway), by Glen Dochart to Strath Tay and the lowlands of southern Pictland to Madderty, Abernethy, Kilrimont (St. Andrews), and Dunblane. This work of Columba and his followers marks one of the turning-points in Scottish history. Its results were to unite at least in a spiritual union all Scotland north of the Forth and Clyde—and in this union Strathclyde, evangelised by the labours of Ninian[3] and Kentigern, might also be included; and, further, to open to all the civilising influences of Irish Christianity a state in possession of part at any rate (Fife and Strathmore) of the Scottish plain, on which, far more than on mountainous Dalriada, the future fortunes of the country were likely to depend. It was the natural sequel to both these facts that in 844 Kenneth MacAlpin united Pictland with Dalriada, and established his palace at Forteviot on the Earn. Further, by bringing part of the relics of St.

[1] Mackinder, *Britain and the British Seas*, p. 216.

[2] In an inset to Plate xxvi.

[3] Bede, *Hist. Ecclesiastica* in Anderson, *Scottish Annals*, p. 7.

Columba from Iona, now exposed to the ravages of the Norsemen, to Dunkeld, the old Caledonian fortress at the gateway of the Highlands, he completed the work already begun by Constantin I., and transferred the religious centre of both kingdoms from an island on the Atlantic sea-board to a position in the central lowland plain.

From Ireland, then, there reached Scotland through the Highlands the first impulse towards unity and the development of a cultured national life. Across the North Sea, on the other hand, came elements totally different in racial stock and civilisation to any existing in Scotland. Though with an interval in date of about 350 years between them, the two attacks, English and Scandinavian, may with advantage be looked at together. Both bodies of invaders, in the first place, belonged to the third great racial division of Europe, Teutonic man, long-skulled like Mediterranean man, of which he was possibly a development, but tall in stature, with blue eyes, and fair in hair and complexion.[1] Both attacks, moreover, must be considered as forming part of the same great expansion of the Teutonic race; and both, as Professor Vidal de la Blache has pointed out,[2] were phenomena of maritime colonisation, based, that is, upon the sea. Hence it was their first preoccupation to keep touch with the sea, a tendency shown in the case of the English invaders by their choice of the fortress on the rocky promontory of Dinguardi (Bamburgh) as the centre of their Bernician kingdom. These English settlements, on the other hand, established by the middle of the fifth century[3] in the valleys of the Newcastle Tyne, the Tweed, the Tyne of Haddington, and the Esk, held the most open and fertile districts of the later Bernicia, and thus controlled the axis of the country. Accordingly the invaders were drawn on to push their conquests up the river-valleys and westward, through the Tyne Gap as far as Whithorn in Galloway, up Tweeddale and Teviotdale to the barrier of Ettrick Forest (*c.* 603), and along the coastal plain of Lothian to Abercorn.[4] On this side the fortress on the volcanic rock of Edinburgh, built or rebuilt by Edwin of Northumbria (*c.* 630), warded the narrow passage, some six miles wide, between the Pentlands and the Forth.

The natural conditions, however, prevalent in the districts affected by Scandinavian settlement, offered no temptations to that second body of Teutonic invaders to abandon that close connection with the sea to which they were naturally inclined. The Norsemen of the fjords, in whose country the mountains forbade communication except by sea, were far more naturally sailors than the inhabitants of the grass-growing alluvial coast regions of Friesland and Holstein, who were primarily stock-raisers, and only in the second place sailors.[5] When, therefore, the Saxon wars of Charlemagne (772-804) first alarmed the Scandinavian populations of the coasts of the Baltic and North Sea, and drew their attention to the fields for plunder and colonisation that lay open to them

[1] Newbigin, *Modern Geography*, p. 210.
[2] P. Vidal de la Blache, *Tableau de la Géographie de la France*, p. 59.
[3] Oman, *England before the Conquest*, p. 241.
[4] Bede's *Hist. Ecclesiastica* in Anderson, *Scottish Annals*, pp. 8, 44.
[5] Vidal de la Blache, *Tableau de la Géographie de la France*, p. 38.

in Western Europe,[1] it was natural for the Norsemen from the Bergen and Trondhjem fjords and Gudbrandsdal, striking westward two hundred miles by a route that must have been well enough known to their traders and fishermen, to reach and occupy the Shetlands and Orkneys, probably early in the ninth century,[2] and then to push southward by way of the Hebrides, seeking settlement in what, to them, were rich and southern lands. It is noteworthy that, though the first attack in 793 upon Lindisfarne was made early in January, later Vikings almost invariably chose the summer for their expeditions, and the term "*sumarlidi*," summer-sailor, became synonymous with pirate. This choice was, doubtless, due in part to the unsuitability of the earlier Scandinavian boats, long and shallow, and carrying a great, top-heavy sail, for facing the North Sea in winter; in part, too, to the greater ease in summer of securing supplies in the district attacked.[3] But it must also be connected with the fact that, while the prevailing winds of Scotland throughout the greater part of the year blow from the west, in the spring and early summer months,[4] they are to a great extent easterly on the east and north coasts of the country. But while it was easy for the Norsemen to reach Scotland in their movement of expansion, the regions to which they had natural access in themselves imposed a definite limit to such expansion. As in all such immigrations, the new-comers aimed at securing conditions of existence as good or better than they had enjoyed at home, but at any rate similar in type.[5] Once settled in the Orkneys, the Norsemen easily over-ran the Old Red Sandstone plain of Caithness, with which the islands are geologically one. Their other colonies were planted down the west coast in the Hebrides, in the short glens heading the sea lochs and fjords of Sutherland, Ross, and Inverness, and in the circumscribed area of *Dalir* (Argyll); while on the east in Sutherland—the "Southland" as distinguished from Caithness—the coastline and the straths opening off it were occupied, and the shores of the Moray Firth as far east as Forres and Burghead. This angle, it may be noted, between the shores of Caithness and those of Elgin, is the only portion of the eastern coastline of Scotland where there occur inlets at all comparable to those of the west, or to the native fjords of the Norsemen.[6] Lastly, a strong Norse colony was, early in the tenth century, settled in Cumberland, Dumfriesshire, and Galloway. Fugitives from Man had emigrated in mass to the fjords of Solway at the time of Harald Fairhair's expedition about 880, and the connection thus established between the island kingdom and the allied mainland colony seems to have been long kept up.[7] The natural conditions of these districts largely explain both

[1] Oman, *England before the Conquest*, p. 405.

[2] W. G. Collingwood, *Scandinavian Britain*, p. 56.

[3] *Ibid.* pp. 66-7.

[4] On an average of 100 years, while only 34 per cent. of the prevailing winds in the whole year for the Edinburgh district blow from the east, in the months of April, May, and June these winds form 47 per cent., 52 per cent., and 42 per cent. of the whole.—J. Cossar, *Geography of the Edinburgh District* (*Scot. Geog. Mag.* xxvii. 644).

[5] Vidal de la Blache, *Tableau de la Géographie de la France*, p. 32.

[6] Sir A. Geikie, *Scenery of Scotland*, p. 186.

[7] Collingwood, *Scandinavian Britain*, pp. 208, 226.

the measure of success which the Viking attack achieved and its ultimate failure. The districts concerned are open to seaward, but in every case walled in to landward by mountain-barriers, which protect them from attack, but render difficult attempts at further expansion. North of the Great Glen the watershed of Scotland keeps close to the western coast, being in some places only 1½ miles from the shore, from which the high ground mounts steeply to an average height of from 2000 to 3000 feet. Galloway, like Argyll, is a district of marked individuality, a backwater from one of the main routes of communication between Scotland and England, and barred from the Scottish Central Plain by the Southern Uplands. In Norse hands, too, it must be remembered, Dumfries and Galloway looked seaward to Man rather than towards Scotland. Lastly, the natural line of advance inland which the valley of the Spey might have been expected to offer to the Viking colonies on the shores of the Moray Firth was entirely discounted by the difference in geological age between the upper and lower sections of that river, and its result that in its lower reaches the Spey is exceedingly rapid, the highest spring tide not ascending more than half a mile above Speymouth.[1] The invaders, in fact, were held apart from combined attack by the nature of the districts they occupied, and between them and the centre of the Scottish kingdom were interposed the mountain masses of the Highlands and Southern Uplands. South of Argyllshire, it is true, with way of entrance by the Firth of Clyde, the Scottish plain lay open: and it has commonly been at this point that an invader from the west has aimed his blow, whether Ivar "the Boneless" at Dumbarton in 869, Somerled at Renfrew in 1164, Hakon of Norway at Largs (1263), or the 9th Earl of Argyll in 1685. But it is significant that here the first brunt fell, not on the kingdom of Alban, but on Strathclyde, and that the rock-fortress of Alclyde (Dumbarton) closed fairly effectually the raider's easiest route.

In the end, though Irish Christianity, entering through Dalriada, gave, as has been shown, the first impetus to national unity in Scotland, though Scottish Gaelic is the form of Goidelic speech which was introduced by the Dalriadic Scots, and until the beginning of the eighteenth century the Highlands remained under the literary dominion of Ireland,[2] yet, in the end, it was the Teutonic influences brought across the North Sea that triumphed in Scotland. The monastic organisation of the Celtic Church was displaced by a system modelled upon that under which Malcolm Canmore's English queen had lived. The sons of Malcolm and St. Margaret established feudalism. The English speech won its way at last even into the Highlands. But there seems no reason to believe that the victory of English speech and civilisation was the result of any considerable admixture of English blood with the pre-existing population. Lothian was English, though even here the evidence of place-names suggests that some proportion of the earlier inhabitants survived the

[1] M. I. Newbigin, *The Kingussie District: A Geographical Study* (*Scot. Geog. Mag.* xxii. 311).

[2] E. C. Quiggin, *Celtic Languages and Literature* (*Encycl. Brit.*, 11th ed., v. 616).

conquest. But at the beginning of the eighth century the Celtic district of Manau still preserved its identity; in the middle of the twelfth Calatria was still known by name;[1] while neither references in mediæval literature nor the historical actions of the Highland clans in regard to Scottish independence show that any distinction of race was recognised to exist between the Scots of the Highlands and the Lowlands. At Northallerton, at Bannockburn, at Flodden, Highland and Lowland fought side by side against a national foe. There was an English migration into Scotland at the time of the Norman Conquest, and subsequently the spread of English commerce brought English blood into the towns. But there is no reason to doubt that, in the main, the independence which Scotland vindicated through centuries of conflict corresponded to an underlying unity of race contrasted with the English, and was upheld by a population in the main of non-English racial origin.[2] In the north and west, however, the admixture of Scandinavian blood must have been considerable. The place-names of Shetland and Orkney are Norse almost without exception, as are many family names; while Norse was spoken till the close of the eighteenth century. In the Lewis the proportion of Norse place-names to Gaelic has been calculated at about 4 to 1; in Skye at 3 to 2; in Barvas 27 to 1; in Uig 35 to 4; in Islay 1 to 2; in Kintyre 1 to 4; and at 1 to 8 in Arran and Man. Most of the shipping terms in Gaelic are Norse in origin.[3] Such was the ethnic composition of the Scottish people: it remains to consider how the frontier was established within which could take place their national development.

The kingdom of the Picts and Scots under Kenneth Macalpin, which by 900 had come to be known as the kingdom of Alban,[4] included a part, but only a part, of the central Scottish plain, in which its rivals were English Bernicia and British Strathclyde. The rulers of Alban accordingly directed their main efforts to the advancement of their frontier towards the south, a policy given effect to by constant raids on the Northumbrian province of Lothian. There was, indeed, no limit to such expansion clearly marked by natural conditions. The Humber and Mersey had formed the general southern boundary of the Northumbrian kingdom which for a time seemed likely to unite all northern Britain in an ecclesiastical and political union till the Synod of Whitby (664) put an end to the Celtic Church in England, and the defeat of Nectan's Mere (685) to the northward advance of Northumbria. The Roman frontier in Britain had alternated between the Wall of Hadrian and Severus, north of the Tyne Gap, between Tyne and Solway, and that of Antonine, which guarded the narrower isthmus between Clyde and Forth. But,

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[1] Anderson, *Scottish Annals*, pp. 50, 197. Manau was probably bounded to E. at Dalmeny, to SE. by Pentland Hills.

[2] See generally R. S. Rait, *Outline of the Relations between England and Scotland* (500-1707), 1901.

[3] Collingwood, *Scandinavian Britain*, pp. 238-9.

[4] Donald, son of Constantin (889-900) is styled King of Alban. The western boundary of his kingdom was the Spey, and it included Perth, Forfar, Fife, and the NE. of Scotland.

on the whole, if two separate nationalities were to exist in Britain, it was most natural that the breach between them should take place on the line where population was, and, by the nature of the surface, was bound to be, least dense; where the sheep pastures of the Cheviots extend across the island, leaving to east and west only a narrow tract of arable land; and where, too, on the east the broad stream of the Tweed affords a natural line of defence.[1] The final adoption of this frontier, however, only took place after centuries of strife, and was largely the result of historical accident.

The landmarks in the Scottish advance are the abandonment to the Scots of Dunedin or Edinburgh, some time during the reign of Indulph (954-962), and the consequent opening of Lothian to their attacks; the victory of Malcolm II. in 1018 at Carham on the Tweed, and the cession of Northumbrian territory north of that river to the King of Scots; and, on the western side, the grant of Cumberland by Edmund the Glorious to Malcolm I. in 945;[2] and the union of Strathclyde with Scotland on the accession of Duncan in 1034. This "forward" policy was energetically continued by the house of Malcolm Canmore, in spite of the loss of Cumberland to Rufus (1092), and the organisation of the defence of the English border by Henry I. Taking advantage of the civil troubles in England, David I., in 1136, secured for his son Henry the territory of Carlisle. In 1139 he added to it by the Treaty of Durham all Northumberland, save Bamburgh and Newcastle; while two years later we find him in possession of Westmorland and the whole honour of Lancaster; whether he held these by a grant from Stephen or by forcible occupation is uncertain.[3] At the same time William Cumyn, who had been David's chancellor, held Durham Castle, which he had secured on the death of Bishop Galfrid, and unsuccessfully endeavoured to secure his own election to the see; and all north-eastern England as far south as the Tees seems to have been in the hands of the King of Scots.[4] In 1144, however, Cumyn gave up Durham Castle: five years later David himself renounced his claims on Lancaster, south of the Ribble, in favour of Ranulf of Chester; and his successor, Malcolm IV., was compelled to surrender his rights over the northern shires to the English king, Henry II. (1157). From this time forward there was no real chance that Scottish territory would be advanced beyond the historic frontier, though the possession of the three northern shires—Northumberland, Cumberland, Westmorland—remained the dream of successive rulers of Scotland, and served as the bait to draw William the Lion and Alexander II. fruitlessly southward in 1173-4 and 1215 to aid Prince Henry against his father and the English barons against John.

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[1] G. G. Chisholm, *On the Relativity of Geographical Advantages* (*Scot. Geog. Magazine*, xiii. p. 478).

[2] The Eden valley in Cumberland is geographically more closely connected with Annandale and Nithsdale than with the Lune valley and the greater part of the lake district.

[3] Lawrie, *Early Scottish Charters*, pp. 105-6, 373; H. W. C. Davis, *England under the Normans and Angevins*, Appendix v. (*Cumberland and Scotland*, 1092-1154).

[4] Lawrie, *Early Scottish Charters*, p. 367; William of Newburgh, *Hist. Angl.*, i. 22 (Stubbs, *Select Charters*, p. 117).

# RECENT AND SUB-RECENT MOVEMENTS OF UPLIFT AND OF SUBSIDENCE NEAR WELLINGTON, NEW ZEALAND.

By C. A. Cotton, of Victoria College, Wellington.

(*With Illustrations.*)

The central portion of New Zealand is shaken by an endless succession of earthquakes. Many of them have their origin in Cook Strait, and are generally regarded as due to earth movements. This view received striking confirmation from the actual uprise of the land which accompanied the earthquake of 1855. An account of this uprise, compiled from the stories of eye-witnesses, was embodied by Lyell in the later editions of the *Principles of Geology*. The movement was of the nature of a tilt, the maximum uplift of about nine feet taking place on the shores of Palliser Bay, twelve miles south-east of Wellington. The axis of the tilt lay on the coast a few miles north-west of Wellington, and still farther to the west, on the opposite shore of Cook Strait, the movement was one of subsidence. In the neighbourhood of Wellington a continuous line of raised rock-platform and beach remains as a reminder of the dormant forces beneath. Advantage has been taken of this line for the construction of roads around the shores of Port Nicholson. At the harbour entrance it extends seaward as a broad platform many acres in extent, surmounted by projecting stacks, and shows the former extension of the drowned ridges of Miramar Peninsula before they were cut back by marine erosion (see Fig. 2).

In Fig. 1 is seen one of the few stretches of the raised beach not yet converted into a road. The rock platform is of moderate width, and, near its shoreward margin, is seen the old storm beach, a ridge of piled up gravel, enclosing behind it a marshy strip. The whole is now clothed with a straggling growth of vegetation.

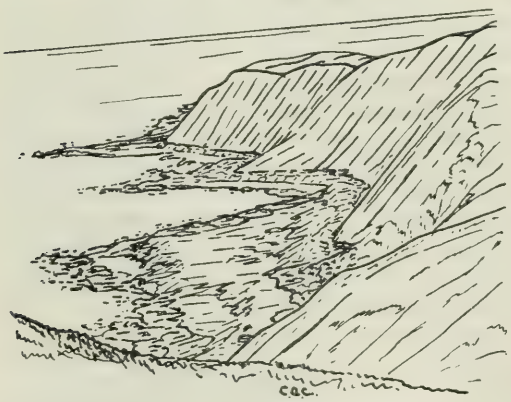


Fig. 1.—The raised rock platform and beach on Miramar Peninsula.

Of even greater interest are the sub-recent vertical movements at Wellington, of which we have only physiographic evidence. Their presentation necessitates, as a preliminary, a brief account of the physiography of the district. This account is abridged from the writer's paper "Notes

on Wellington Physiography" presented for publication in the *Transactions of the New Zealand Institute* (not yet published).

Wellington is situated on the harbour of Port Nicholson, a broad sheet of deep water at the south-western extremity of the North Island of New Zealand (see Fig. 2).

The surrounding country is of strong relief, being part of a range of folded greywacké and argillite rocks which extends far to the north-east,

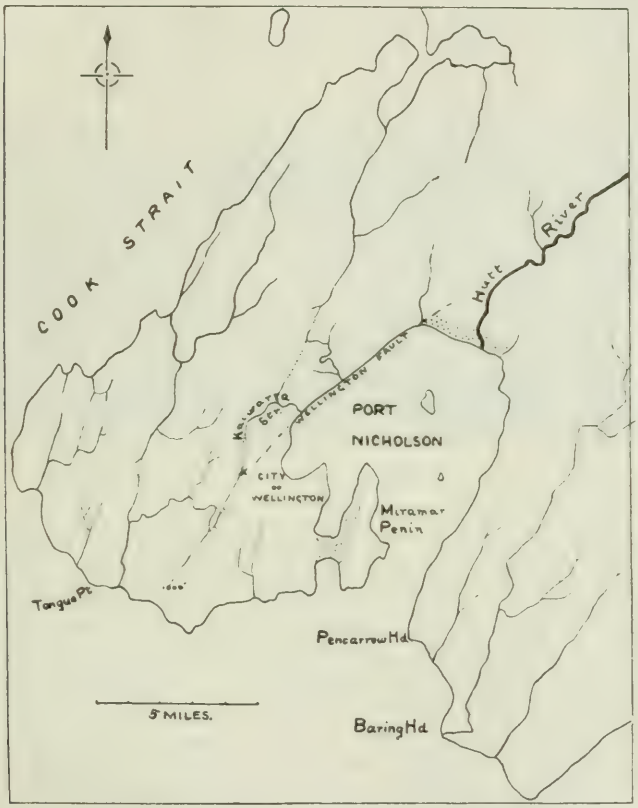


Fig. 2.—Sketch-map of the environs of Wellington.

and, it is believed, has its continuation to the south-west in the South Island, beyond Cook Strait. In the area shown in Fig. 2 this great series of rocks is the only one represented, with the exception of a few small patches of recent sand and gravel. The rocks are much deformed, standing usually nearly vertically, but, owing to their unfossiliferous nature, their structure has not been made out. The strike of the beds is, however, fairly constant, and lies a little east of north. The rocks are of varying hardness, the softer bands consisting of both argillite and greywacké traversed by innumerable joints, while the more resistant

parts are bands or lenticular masses of indurated, coarse greywacké with few joints, and bands of jointed greywacké re-cemented by a deposit of vein quartz. The features of the land surface have been sculptured by normal agencies working during a movement of uplift which appears to have affected the whole area, though perhaps not all quite equally. If we neglect the very slight influence of the 1855 uplift on the topography, forms belonging to three cycles are recognised. The latest cycle is still in its youthful stage. Where the streams cross hard rocks they are enclosed in steep-walled gorges, and are not graded except near their mouth: where, however, they follow the strike of easily eroded rocks they are graded and have worked out strips of flood plain.

Forms of the next earlier cycle indicate that, when interrupted, the cycle had reached a fairly mature stage. Stream courses had been graded, and broad flood plains formed, benches of which still remain. Since the interruption of this cycle, uplift of over two hundred feet has taken place.

We have, lastly, a cycle represented by the summits of the hills and ridges which rise above 950 feet. At about this height there are, in the peninsula west of Wellington, remnants of a nearly level surface, above which, however, rose numerous hills, some of which are now over 1500 feet above sea-level. Their summits present gently rounded outlines, in strong contrast with the rocky precipices and ravines of their lower slopes. It is clear that they formed a mature land surface, since elevated and dissected.

A striking feature of the topography is the marked parallel arrangement of the major valleys and ridges. This may be noted even on the rough sketch map, Fig. 2. So continuous is the ridge that separates Wellington from the valley to the north-west that the main road is forced to climb nearly 800 feet to cross it. The arrangement of valleys and ridges is parallel to the strike of the rocks, and is evidently an instance of mature adjustment to structure, inherited from an earlier cycle. It may be inferred that adjustment was completed in the earliest of the cycles described above, and it may have been partly worked out in a still earlier erosion period. It is noteworthy that changes that have taken place in drainage, owing to capture in later cycles, have had the result of partly destroying the earlier adjustment. Such changes may be regarded as due to accident, and their cause appears to be the subsidence of adjacent land blocks. It will be noted that the line of the north-west coast cuts obliquely across the strike of rock-strata, streams, and ridges, and that the southern coast crosses the strike transversely. All evidence seems to point to the conclusion that the peninsula is but a remnant of the earlier land on which the strike valleys originated, and that the coast is determined by lines of fracture. The actual coast is fronted by a line of lofty cliffs, in places 700 or 800 feet in height. Their sharp-edged, faceted form they owe to active marine erosion, and the slight irregularities of the coast are due to the same cause, the hard rock bands standing out as headlands. The larger streams, in most cases, enter the sea in bays, but this is only because wave action has been

able to hollow out bays on outcrops of the same soft strata as those which the streams follow.

Around parts of the coast wave-cut rock platforms are to be found at high levels, confirming the evidence of uplift given by the forms of the

Fig. 3.—Marine terrace at Tongue Point.

land surface. One of these is as much as half a mile in width at Tongue Point on the south-west coast (see Fig. 3). The writer has attempted to correlate the period of formation of this platform with the intermediate geographical cycle referred to above. It was cut when the land stood about 240 feet lower than at present. It slopes gently seaward, and is covered with a layer, a few feet in thickness, of gravel and flattened shingle exactly similar to the materials composing the existing beach.

Fig. 4.—Part of the Wellington fault scarp, as seen from Wellington.

Above the broad platform is a narrow remnant of one still older, at a height of 450 feet. Like the lower platform it is covered with water-worn gravel. South-east of Port Nicholson, along the coast beyond Pencarrow Head, there is another somewhat similar series of platforms. They are particularly well developed at Baring Head.

After the foregoing presentation of evidence of a continued move-

ment of elevation of the land block practically as a whole, the presence, in its midst, of the basin of Port Nicholson must be accounted for. The block occupied by Port Nicholson and the comparatively low ridges which separate it from the open sea on the south-west appears to have a history different from that of the remainder of the district. The ridges west of the harbour are undoubtedly drowned. One of them, Miramar Peninsula, has been an island and is united to the mainland by a sandbar. The only acceptable explanation of the present state of this area appears to be that it has subsided independently of the surrounding

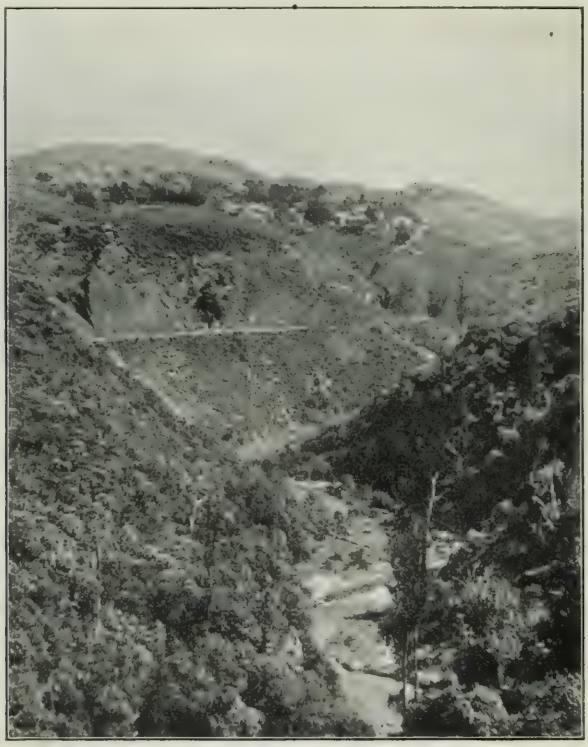

FIG. 5.—View looking up the Tower Gorge of the Kaiwarra stream.

land. The actual boundaries of the subsided block are not all quite clear, but, along the north-west shore of the harbour, it is bounded by a very clearly-defined, recent fault scarp.

Its base line, as the map and the sketch (Fig. 4) indicate, is very nearly straight. It really traces two curves, of wide radius, concave towards the harbour, separated by a similar convex curve. The average strike of the fault plane is north-east, and the throw of the fault at least five hundred feet. An idea may be gathered, even from the rough sketch-map, of the manner in which the fault scarp cuts across the course of the well-defined strike-ridges to the south of it. This fault scarp

affords a good opportunity of testing the criteria worked out for the recognition of recent fault scarps by Professor W. M. Davis[1] in the mountain ranges of the Great Basin. All are here found, although on a relatively small scale. In Fig. 4, in addition to the straight base-line, the row of terminal facets will be noted. Had these been formed by the truncation of earlier, tapering spurs by wave action, instead of by faulting, rock platforms in the harbour ought to show the former extent of the spurs, and the rock platforms ought to have been uplifted, like those of the outer coast, by the tilt of 1855. These are, however, conspicuously absent, and soundings show depths of twelve fathoms in the harbour, within a short distance from the shore, opposite spurs and ravines alike. Of the ravines separating the facets of the fault scarp two have cut back across the strike of the rocks and have captured the drainage of a longitudinal valley belonging to the older topography. Portions

FIG. 6.—"Domestic Piracy" in the Kaiwarra stream. View looking west.

of the old valley floor, aggraded with gravel and other stream deposits, can be traced at heights of 500 to 600 feet. The streams of the fault scarp are graded for only a short distance from their mouths, and, throughout their length present the characteristics of extreme youth. Fig. 5 is a photograph of the gorge of one of them, the Kaiwarra, near its mouth, where it has developed a narrow strip of flood plain.

It was with reference to the longitudinal valley invaded by these ravines that the statement was made on an earlier page, that the result of recent captures has been to destroy, rather than complete adjustment to structure. The old valley may be traced in Fig. 2. Where not now occupied by streams it is indicated by a dotted line. Its head is at a height of 1000 feet above sea-level, and is less than a mile from the coast. Clearly such a valley would be unstable even when the land

[1] *The Mountain Ranges of the Great Basin. Bull. Mus. of Comp. Zoology*, Harvard, Vol. xlii. 1903, pp. 129-177.

stood hundreds of feet lower. It must have been developed on a more extensive land surface, and it is the presence of such valleys, more than anything else, that seems to show that the Wellington district is a horst, isolated by the subsidence of blocks to south and west.

The headwaters of the stream which formerly occupied the old valley have been captured by a tributary of a stream which enters the sea not far from its source. The capture is a double one, as indicated by the dotted lines in Fig. 2. At the elbow of capture the stream now flows in a gorge about 500 feet below the level of its old bed. Further down the old valley, at the point marked X in Fig. 2, there is an example of what has been termed "domestic piracy." The sketch, Fig. 6, depicts the point where the stream has been captured by its own tributary. Since the capture took place the diversion to the Kaiwarra has caused strong revival, and far above the present stream, in its young gorge, the old, dry channel swings away to the north on a level with a flood plain remnant which is a terrace in the upper valley of the stream.

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## MRS. LIVINGSTONE BRUCE AND THE SCOTTISH GEOGRAPHICAL SOCIETY.

By J. G. Bartholomew.

(*With Portrait.*)

It was at North Berwick on a Sunday afternoon in the summer of 1884 that the project of forming a Scottish Geographical Society was proposed to Mrs. Bruce. It came up rather as a sort of remote ideal that had little prospect of realisation. It had been proposed before and discouraged by various kind friends! But Mrs. Bruce's eyes sparkled with enthusiasm, and she said it was just what her father would have welcomed—Why should it not be possible? As we talked on, the possibilities became more hopeful, and eventually, when Mr. Bruce appeared an hour later, all difficulties seemed to vanish under the influence of his cheery optimism. Before midnight a prospectus was drafted, and by next day Professor Geikie had given it his blessing. That was the beginning of the Scottish Geographical Society.

But it is an easier matter to dream dreams of ideal projects than to realise them. Then the real work begins, and only those who were associated with the very early days, when the nucleus of the Geographical Society was being formed, know how much drudgery and discouraging spade work had to be done. During the following weeks I am afraid that Mr. Bruce's business and some other people's businesses saw very little of them! We spent days canvassing likely people from house to house, frequently encountering candid friends who assured us of the utter futility of our project. Night after night saw us in the Chamber of Commerce Rooms in Melbourne Place, usually until after one in the morning, writing letters, addressing circulars, and planning arrangements. Mrs. Bruce was almost always there, and not only her

THE LATE MRS. LIVINGSTONE BRUCE.

active assistance but her simple presence did much to inspire enthusiasm and help on the work. As we walked homewards by the Post Office and Regent Terrace we were sad or cheerful according to the number of new members we had secured that day.

After having formed a nucleus of workers and supporters, sufficient to justify further procedure, funds were raised to meet preliminary expenses, and the next stage, that of organising the Society's work, was undertaken by special committees. No time was lost over this work, with the result that in three months after its first inception the Society was formally constituted on the 28th October 1884, with no fewer than four hundred names on its roll of membership. The Lord Provost of Edinburgh, Sir George Harrison, presided over a large and representative meeting in the Chamber of Commerce. Professor James Geikie moved the formation of the Society, Lord Rosebery was elected President, Vice-Presidents and an influential Council were also elected, Mr. A. L. Bruce was appointed interim hon. treasurer, and Mr. J. G. Bartholomew interim hon. secretary. The ship was now fairly launched and fully manned. All promised well, but the voyage was yet to begin, and predictions of disaster were not wanting. It was through the influence of Mrs. Bruce that Mr. Stanley was persuaded to come to Edinburgh and deliver the inaugural address to the Society on the 3rd of December. Lord Balfour of Burleigh presided over this great and brilliant meeting in the Music Hall. Next day the Society's first rooms at 80 Princes Street were opened, and the daily routine of the diffusion of geographical knowledge was duly commenced. Success now seemed to be assured. The Press agreed that it was an admirable institution, and people now wondered why there had not been a Geographical Society before!

In 1893 the Society sustained its first great loss in the untimely death of Mr. Bruce. A man of high ideals and great public spirit combined with keen business capacity, he brought success to most enterprises with which he associated himself. He was cut off in the prime of his career, and it can only be imagined what a loss he was to a wife with whom he shared so many great interests. But Mrs. Bruce continued her connection with the Society and its work, and in 1910 she signified this in a most generous manner by the gift of £1000 for the endowment of a Livingstone Gold Medal in memory of her father. The medal was to be awarded by the Council for distinguished services in exploration or geographical research, and the first recipient was Sir Harry Johnston, the African explorer.

Mrs. Bruce was born in 1848 at Kuruman in Bechuanaland, where Dr. Livingstone was then settled as a missionary. The first four years of her childhood were spent in the Dark Continent, and from that time onwards Africa was the chief interest of her life. In this respect she was most truly her father's daughter. Her mind was always occupied with some project or other connected with the welfare of the land of her birth, and from beginning to end she keenly followed all the developments in its wonderful evolution. Her lifetime may be said to have almost coincided with the period of the exploration and opening up of

Central Africa. It was the period of pioneer explorers, a period that has just passed away and given place to the next stage of settlement and development. In that later stage the Livingstone-Bruce family still continue to take a prominent part, and we now find Dr. Livingtone's grandson managing the family estates and growing cotton and tobacco on the country first trodden by his grandfather as a pioneer explorer. Some of these changes are indeed dramatic. In 1855, Livingstone, a solitary traveller, discovered the Victoria Falls on the Zambezi River, and in 1909 his daughter, Mrs. Bruce, travelled from Cape Town to the Falls by railway sleeping and dining cars to find the great Zambezi gorge spanned by that wonderful railway bridge on the northward route to Cairo. Cattle and sheep now browse in peace on the plains where lions and hyaenas formerly reigned supreme.

By her own enthusiasm in the cause of Africa, Mrs. Bruce inspired many others with greater ideals for its future, and some of them have borne fruit in most unexpected ways. Imbued with a spirit that had strong and decided convictions on most questions, she was always patriotically and imperially British, with a high sense of the world-wide responsibilities of her country, and absolutely no sympathy or patience with the "Little Englander." In Edinburgh social life she had great influence, and her unique geographical receptions will not soon be forgotten. The brilliant gatherings that assembled to meet Stanley, Lord Roberts, Sven Hedin, Lieutenant Peary, Captain Scott, Lord Milner, Sir Harry Johnston, Sir George Goldie, and many other distinguished travellers, are events intimately connected with the history of the Geographical Society.

These and many other pleasant memories are associated with a personality of great strength of character and charm, and the memory of Mrs. Livingstone Bruce ought long to be cherished by the Scottish Geographical Society as one of its founders and chief benefactors.

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## THE AUSTRALASIAN ANTARCTIC EXPEDITION, 1911.

By William S. Bruce, LL.D., F.R.S.E.

News has been received in this country of the successful landing of the Australasian Antarctic Expedition, under the leadership of Dr. D. Mawson, on Adelie Land. Unfortunately, just as the American discoveries by Johnson and Morrell in the Weddell Sea were discredited without much reason in Britain during the whole of last century, so also the American discoveries to the south of the Indian Ocean made by Wilkes were discredited not only in Britain but also in Europe generally. Any one, however, who had carefully read Captain Wilkes's narrative, must have felt that there was sufficient evidence for the American discoveries, and the writer, for one, has always upheld the view that those lands would be found to exist more or less in the position in which Wilkes charted them. In the *Narrative of the "Challenger,"* the opinion is expressed

that "it is probable that Termination Land does not exist,"[1] and Professor Drygalski, in his map of the region explored by the *Gauss*, omits to insert Termination Land. Indeed in almost every map produced, Termination Land, if inserted, bears at least a question-mark against it. It is interesting to note also that the map which Ross said he had received from Wilkes is not the same as the map which Wilkes says he gave Ross—the Ross reproduction making the land stretch more to the eastward than Wilkes's reproduction. It should be understood that the getting of accurate longitude and even latitude in these regions, where it is not always possible to get a solar observation, and at a time of the year—in continuous daylight—when it is impossible to obtain any stellar ones, is so difficult, that it is scarcely fair to say that a land does not exist because it is not within a few miles of the assigned position; and in the matter of longitude this is especially the case, for it is just as likely that the ship which maintains that the land is not in such and such a position may itself not be where it thinks it is. The *Challenger* officers believed they were fifteen miles from the position of Termination Land where they got a depth of 1300 fathoms. They could see no land from the crow's-nest, where it was clear, and at that time the depth was considered to be too great for land to be near. But when we recollect that the *Scotia* got a sounding of 1131 fathoms within eleven miles of Coats's Land, and another sounding of 1746, we may safely say that when soundings of less than 2000 fathoms are taken in these far southern regions, that it is an indication of the presence rather than the absence of land. Consequently Dr. Mawson's plan to explore this much-disputed coastline was of the greatest importance, especially because from all accounts it appeared to be—what had been seen of it—a most inhospitable coast, and a region in which considerable difficulty had been experienced on account of the heavy ice that fringed its shores. The fact, also, that a great part of this coast consisted of perpendicular ice-cliffs of considerable altitude, made it certain that landing would only be effected with difficulty.

There has not been the same popular *éclat* regarding this Australasian Expedition that has been given to some others, and perhaps the chief reason for this lack of interest in Dr. Mawson's expedition is that it is in no sense a Pole-hunting one, and has not in any way, as it were, played to the gallery. Dr. Mawson is a well-known Australian geologist, extremely well acquainted, not only with the geology of Australia, but also with that of Victoria Land, especially in its relation to Australia. Besides being a geologist of great repute, Dr. Mawson is in other respects a highly trained scientific man, and has paid special attention to magnetism, having been in charge of the magnetic work undertaken by one of the party of three who, in Sir Ernest Shackleton's Expedition, not only attained the South Magnetic Pole, but also took magnetic observations at, and in the vicinity of it. While serving with that expedition, he

[1] *Narrative of the Cruise of the "Challenger,"* vol. i. part i. p. 407, by John Murray.

was also one of the party who ascended for the first time Mount Erebus (13,120 feet). He thus had substantial experience as an Antarctic explorer before he undertook the present expedition.

No expedition has ventured during seventy-two years to approach this forbidding land again, until this courageous Australian launched forth, fully determined to make out what he could concerning it, and to endeavour to find out what relationship it had to Victoria Land and the rest of the Antarctic Continent, as well as to Australia and New Zealand. Thus it was Mawson's plan to land three parties on this practically unknown coast, and he has, by successfully landing two parties, accomplished more than could have been hoped for by those who know. The coast was discovered by Captain d'Urville on January 21, 1840, and was visited by Wilkes on January 30 of the same year. Dr. Mawson has himself landed with a party of fourteen at Point Alden, the eastern part of Adelie Land, where he has set up an encampment, and is at present spending the winter with the intention of carrying on meteorological, magnetic, geological, and other scientific investigations, whilst exploring the lands and seas in the vicinity from a topographical aspect. The reports meantime available give the most meagre description of this interesting land, evidently because Dr. Mawson and his companions were entirely occupied in landing stores and equipment, and setting up the house for winter quarters. The approach to Wilkes Land was made not without difficulty on account of fog, snow, and heavy gales. The ice-pack also was not negotiated without difficulty. After leaving Macquarie Island and "proceeding some days west-south-west," says Lieutenant Mennis, "we sighted a barrier very similar to the Ross Barrier, varying from 40 to 100 feet in height, with an irregular edge running generally south. Afterwards, we passed rocky islets just off what appears to be the northern extremity of the southern ice-cap. On January 9, while it was blowing a heavy gale, we sighted some more land jutting out from the barrier's edge, and we made for it. As there were numerous small islands and rocks just awash, and with the soundings showing a very irregular bottom, the ship was brought-to about two and a half miles out. As we were already further west than we had intended to make our main base, Dr. Mawson and I, with Bickerton and five others, lowered a whale-boat and pulled in. We found the land to be the outcrop from that covered by the ice-sheet, and composed of ice-worn rocks and loose boulders and moraine, about a mile long and half that depth, the highest point being about 200 feet high."

At Point Alden a fine boat harbour was found, and enough water for the ship to get within 200 yards, so Dr. Mawson decided to set up his first station at that point. The landing was not effected without difficulty, on account of very heavy gales and low temperature. The ice-cap in this region rises very rapidly up to about 2000 feet, and the coast is described as a bad one, "all heavily ice-clad and badly crevassed, fairly steep slope from about 2000 feet, and finishing with a cliff face 100 to 300 feet. Occasionally we saw a rock in the face, but very seldom."

Having landed Dr. Mawson, Capt. Davis, who is master of the

*Aurora*, proceeded to the westward in a more or less zigzag course, along about the 65th degree of latitude, and about 250 miles to the westward he discovered land rising to a height of 2500 feet, very much of the same character as Adelie Land, but considerably further south than the land charted by Wilkes in these longitudes. It was impossible to get nearer than eighteen to twenty miles from this land on account of the close and heavy nature of the pack-ice. Consequently the *Aurora* steered a course westward, and ultimately landed a party under the leadership of Mr. Wild on about the Antarctic circle (66° 21′ S.), in longitude 95° 9′ W., 1200 miles west of Dr. Mawson's station. It is interesting to note that this is the land to which I have already referred, charted and called Termination Land by Captain Wilkes, whose existence has been doubted by others. It is therefore of extraordinary interest that the party of the Australasian Expedition under Mr. Wild has not only confirmed Wilkes's discovery of Termination Land, but has actually landed and set up winter quarters there. The landing of this party was an even more remarkable accomplishment than the landing of Dr. Mawson's party. For one reason, it was fully a month later in the season, and was accomplished under most difficult circumstances, the stores having to be got up by means of shear-legs on to the top of a precipitous ice-cliff 100 feet high. It may be interesting to quote Mr. Wild's description of the landing at the second base:—

"We have had a pretty bad time. We encountered a four days' gale after leaving Clairie Land, and then sailed south of Sabrina, but saw nothing, and all the time were skirting a very heavy pack. We now centred our hopes on Knox Land, but were unable to get within sixty miles of it. For two days we were dodging about there, and finally got jambed amongst some very heavy floes as solid as rock, and had a deuce of a job to get out. Davis (the captain of the *Aurora*) and I then had a consultation about the advisability of returning to Clairie Land as against going further west, as we only had seven days' coal left, but finally decided to go west, when we got into what Wilkes called Repulse Bay. We found a barrier and no bay, and followed the barrier through to the west, thus making south-west. We got down again to 66° S. and 94° 30′ E., when we saw land to south, but were stopped from making any landing. That had completely gone, and as a last resort we decided to run back to the barrier and see if it would be reasonable to make a landing there. We started back on February 5, but as soon as we got clear, instead of heading straight back to the barrier, we found we could get some distance into the south-east. After half a day's steaming we came up to another barrier with some two years' floe still hanging on in a large bay. The snow-drift from the barrier made it possible to get up in one place about 100 yards from the edge of the floe, and I went up with two of my party to have a look round, though I had no hope of being able to make a base. When I got on the top, I found it was not a barrier but a glacier, and not half so badly broken up as it looked from the ship, and, in fact, quite a reasonable place to winter; so we decided to land. The principal difficulty was to get stores on a glacier about a hundred feet high, but that we have almost got over. We rigged shear-legs on the glacier, and buried a kedge in the floe down below, set up three inches of wire traveller, and have now got everything up except coal, and that we hope to finish about 5 P.M. to-morrow. As you can understand, it has been very

hard work, and it will be a great relief to us all when we are through. This glacier should eclipse the Beardmore by at least 50 miles in length and 30 in width."

Besides landing parties at the east and west end of Wilkes Land, a third party of five was landed at Macquarie Island, and an installation of wireless telegraphy set up.

The whole of this first summer season has been taken up in landing these two parties, and now work is being carried on for twelve months until they are relieved by the *Aurora* next southern summer. During this time the ship will prosecute oceanographical research—for which she is specially fitted out—to the south of Australia. It is interesting to note in this connection that the provision of a considerable part of the apparatus was undertaken by the Scottish Oceanographical Laboratory, Edinburgh, the trawling-gear being made at Granton under the director's personal supervision. The *Aurora* also carries with her the quick-working winch which was used on board the *Scotia*, and made by Mr. James Reid of Paisley, to haul in the sounding-wire and deep-sea instruments used for the determination of the temperature and specific gravity of the sea, and for working tow-nets and other relatively light apparatus in considerable depths. Both Dr. Mawson and Captain Davis paid visits to Edinburgh and Glasgow, and made a special inspection of the gear used by the Scottish Expedition, and also of the large scientific collections made by the *Scotia* in the Weddell Sea. The work being carried on by the *Aurora* between Australia and Wilkes Land (as the whole of this land may be termed) resembles closely the work of the Scottish Expedition, the special object being to make a deep-sea survey which shall indicate what previous continental connections there have been between Australia and this part of the Antarctic Continent.

To summarise, the Mawson Australasian Expedition has proved, over a distance of more or less 1200 miles, the existence of Wilkes Land, which has been disputed during the past seventy-two years, and has set up stations at the west, and almost at the east end of it. Dr. Mawson has thus done much to support the theory of there being one continental land-mass round about the South Pole, and as a geologist, as well versed in Australian and Antarctic geology as any living man, will be certain to bring back a rich harvest of valuable results bearing on the formation of Antarctica. His oceanographical survey between Antarctica and Australia will also be a most valuable contribution to geography and biology, and the meteorological and magnetic observations taken cannot fail to be of economic worth.

It is gratifying to note that Dr. Mawson and his companions are concentrating their whole energies on important scientific work.

## PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

### Death of Mrs. Livingstone Bruce.

At a Meeting of Council held on Tuesday, April 23, it was resolved that the following should be put on record in the books of the Society :—

"The Council expresses its profound regret and great sense of loss at the death of Mrs. Livingstone Bruce. It records its high appreciation of all that she did for the Society, especially her invaluable services in conjunction with her late husband at the founding of the Society, and also her gift of the Livingstone Medal in memory of her distinguished father, Dr. Livingstone. During the past twenty-eight years of the Society's existence, she cherished all its interests, and was always ready to extend her generous hospitality to the distinguished travellers who from time to time came to Edinburgh under the Society's auspices."

The Secretary was instructed to send a copy of this minute to Captain Livingstone Bruce.

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## GEOGRAPHICAL NOTES.

### Polar.

**International Polar Commission.**—We are informed that this Commission will meet at Rome, during the meeting of the Tenth International Geographical Congress, on Wednesday, April the 2nd, 1913, at 10 o'clock, at 102 Via del Plebiscito. The Commission was to have met at the same time as the International Geographical Congress in October 1911, but was postponed when the meeting of the Congress was put off.

### General.

**The late Professor R. S. Tarr.**—In connection with the note on a proposed expedition to Newfoundland which appeared in our last issue (p. 268), we regret to state that the leader, Professor Ralph Stockman Tarr, died at the end of March after a short illness, in the prime of life. Professor Tarr, who at the time of his death occupied the chair of Physical Geography at Cornell University, was best known by his researches on the glaciers of Alaska, which have been often alluded to here, and also by his various text-books on physical geography. His early death is a great loss to geographical science.

**The late Mr. George Borup.**—Geographical science has sustained another loss in the premature death of Mr. George Borup, who was accidentally drowned in Long Island Sound at the end of April. As already explained here, Mr. Borup, who accompanied Peary on his last expedition, had his preparations far advanced for an expedition to Crocker Land (cf. pp. 211 and 269). He was assistant curator of geology in the American Museum of Natural History, and had devoted

much time to field work with a view to fitting himself for geographical exploration of a scientific character.

**Fiords in Relation to Earth Movements.**—Professor J. W. Gregory recently delivered a lecture on this subject at the Midland Institute of Birmingham, and a report of the lecture appears in *Nature* for April 18. Professor Gregory first gives some account of the different types of coastlines, and draws up the following list of characters of fiords as seen on the ordinary map: (1) they form long, straight narrow channels, crowded together and running far inland; (2) their walls are high and steep; (3) their channels have parallel sides, and bend or branch at a sharp angle, the angle tending to be constant for a district; (4) the fiord valleys are often arranged along intersecting lines like a network of cracks; (5) fiords occur in connection with dissected plateau regions; (6) the result of this position is that the valleys of the plateau "hang" over the fiords, giving rise to characteristic waterfalls; (7) the land available for cultivation is limited to an area at the head of the fiord or on small deltas at its sides. Such fiords occur in high latitudes and in regions formerly strongly glaciated, but Professor Gregory is of opinion that the past glaciation will not account for the origin of the fiord: in some instances the movement of the ice was not along the fiords but at right angles to them; this occurs, for example, in the Shetland Islands where the fiords trend north and south while the ice moved from east to west. Further, he believes that there is evidence that the fiords, however they may have been modified by ice, were in origin pre-glacial, and were produced by a series of earth movements in Pliocene times. He believes that after the great Miocene movements which produced the Alps and the other great mountain chains of Tertiary origin, there occurred, mainly in Pliocene times, a series of uplifts which in areas of old rocks led to the formation of intersecting cracks, and these intersecting cracks, when acted upon by water and ice, gave rise to the fiords. The characteristic sill at the threshold of the fiord is perhaps due to a tilting of the country at the last uplift. But uplift alone will not account for fiords; there must have been depression in order to allow the sea to enter the cracks, and fiord areas are thus regions which have undergone movements, both of elevation and depression. They seem to be the result of a deformation of the earth which is more marked in the polar than in the tropical zones. In the final sentence of the lecture:—"The ultimate cause of fiords is the rupture of certain wide areas of the earth by the pulsation of the crust under the play of titanic forces set at work by the great Miocene disturbances which upheaved the chief existing mountain systems of the world."

## EDUCATIONAL.

The Scotch Education Department and the Teaching of Geography.—As already indicated (p. 270) the long-expected *Memorandum on the Teaching of Geography in Scottish Primary Schools* appeared

some time ago. Perusal of this pamphlet seems to confirm the opinion which has been already formed by some critics, from the papers set in both grades of the Leaving Certificate examination, and other forms of the Scotch Education Department's activity, that this Department is more or less out of touch with the actual teaching of geography in Scottish schools, and, though doubtless actuated by the best intentions, is in danger of acting as a drag upon its natural development in the country. To those who know the facts, an inspection of the papers set at the Leaving Certificate examination in recent years will, we think, lead to the conclusion that these err in several directions. Firstly, they tend to be too difficult, the standard being raised more rapidly than is advisable in the interests of either teacher or child; second, with apparently the desire to be ultra-modern, they tend to regard geography as synonymous with the shibboleths of particular schools; thirdly, they indicate that the Department is out of relation to actualities, both from the scholar's and the teacher's point of view—it asks for something which neither can reasonably be expected to give. All these defects, as it seems to us, reappear in the *Memorandum*, thus suggesting that they are an integral part of the present policy of the Department.

Before endeavouring to give proofs in support of this indictment, we may begin by admitting that the pamphlet contains much to which no objection can be taken; for it contains much which has been said here many times; much which has been said by all the different authorities which have spoken on the subject; much which was detailed in the London County Council *Report on the Teaching of Geography* summarised and criticised here in vol. xxvii. p. 317. A large part of this is no doubt excellent stuff, and teachers will be glad to have it collected and made available at the modest outlay of 2½d. Our complaint is that the person responsible for the compilation of the *Memorandum* does not seem to have sufficient practical experience to enable him to deal with the material collected, and goes off the rails precisely at those points where the teacher may reasonably expect definite guidance. Some of us have lived through the earlier period when "Nature Study" occupied that commanding position which is now taken over by geography, and read many pamphlets and discourses on the teaching of the subject. This exercise led us finally to feel that what the majority of the pundits were saying was:—"Take the children out into the country and show them the pretty flowers." The Scotch Education Department seems to us to have remained precisely at this level in regard to geography, but, as befits a Government Department, it expresses itself in more dignified language—the children are now to "extend their observations to the exploration of a neighbouring burn." The teacher whose school is in a Glasgow slum will probably feel that after this the subsequent injunction to apply the scholar's knowledge "to explain the relations of mountains, rivers and plains to each other, and to the distribution of various forms of life, particularly of human life, as governed by the evolutionary process," is a mere trifle. The result of his teaching, he is assured, will be that "it may begin to dawn upon the older pupils that the earth is not only the theatre of

that process, but the most stupendous example of it," thus giving rise to the terrifying thought that the Department has a whole series of other worlds on its shelves, all of which illustrate "the evolutionary process" in human life to a minor degree. The philosopher might, we think, have something to say to this use of words, and the practical teacher, dealing with children of thirteen or fourteen in the flesh, will suppress a smile. Does the Department seriously think that this has any value whatever to the teacher? We must ask further whether the Department does not know that the vast majority of elementary school children live in towns, in densely settled regions where a free exploration of open country is rendered absolutely impossible? Does it not realise that the shops of those towns are full of objects of great interest to the child, which illustrate geographical phenomena in a most striking fashion? Have its members stuck so closely to their Ordnance Survey maps that they do not know that Cape plums in a Princes Street shop in mid-winter suggest to the true teacher an infinity of lessons on the seasons, on means of communication, on a hundred points of geographical interest?

Unreal as much of the body of the *Memorandum* seems to us to be, we must add that much of Appendix II., entitled, "Study of Local Geography with Ordnance Survey Maps," is from our point of view worse. A considerable number of the detailed recommendations seem to us to err against every canon of good method, both in what they recommend and in what they omit to recommend. We may take as a special example the instructions as regards area measurements, which, as all who have seen the Higher Grade Leaving paper in past years know, is a favourite problem with the examiner. Several detailed recommendations are given here, the areas in each case to be calculated with squared paper. Now these calculations are laborious, very tedious, inaccurate, and absolutely unreal. Not only does the average scholar get hopelessly fogged with his decimal places, but, if he be a country boy, or one who has any practical acquaintance, even the most rudimentary, with land measurement, he knows that his results would be regarded by the practical man as ridiculous, and he naturally feels that the teacher is trying to "have him on." One of the recommendations is that the children should measure the area of a parish. Now this is a piece of information which can be got perfectly easily, and which is quite often in the possession of country folk. To ask a boy to spend much labour in getting a result which, even when reduced from his decimals into a notation which he recognises as reasonable, is likely to differ from the actual fact known to his father, and to differ in units of whose value in terms of produce he is perfectly well aware, is to us to sin against him. Some of the other suggested exercises seem to us even more unreal and unjustifiable.

Finally, we should like to enter a protest against the statement of aims laid down in the first section—though well aware that the protest is useless, for this particular statement represents the attitude which dominates headquarters in regard to elementary education throughout Great Britain. The statement objected to is that "the only plan that

meets all cases is to cover the whole ground before the qualifying stage." In other words the maximum possible information is to be shoved into the elementary school child before he leaves school, in the sure and certain hope that he will never want to open a book again once he is free of compulsory schooling. It has been already pointed out that what is wrong with our system of education is that it is dominated through and through by class. In England especially the idea is all but universal that the child of well-to-do parents should have his mind developed, preferably by means of the classics, which give him the minimum of useful facts, while the poor man's child is to be stuffed with facts on the assumption that he will never acquire them if they are not thrust into him. But is it so bad, need it be so bad, in democratic Scotland? Can the child not leave school with a desire for reading, with a knowledge of where books are to be got? Is the highest ideal that the Scotch Education Department can offer us the assurance that the plan they recommend will "secure" that the school children "will not leave school entirely ignorant of any important part of the earth's surface"? Won't they really? We left school ourselves with quite an extensive ignorance of many important parts of the earth's surface, and hope to preserve much ignorance for many a long year. How else can one look forward to the joy of learning?

Formation of Geographical Association in Scotland.—With the object of providing a means of discussing such problems as may arise in connection with the status of the subject, and generally to promote the teaching of geography on modern lines, there was formed, at a meeting held in the Geography class-room at Edinburgh University, on Saturday, May 18, under the presidency of Mr. George G. Chisholm, an Association of Teachers of Geography in Scotland. The Chairman said that a committee which had been appointed had recommended the formation of the Association, under the auspices of the Royal Scottish Geographical Society, a proposal which had been entertained by the Council of the Society with the utmost readiness [cf. p. 209]. On the motion of Mr. T. S. Muir, Royal High School, Edinburgh, seconded by Mr. Findlay, George Watson's College, it was agreed to form the Association. Mr. Chisholm was appointed chairman; Mr. Cossar, Lecturer in the Training College under the Glasgow Provincial Committee, and Mr. Frank Spence, Principal of the Training College, Moray House, vice-chairmen; and Mr. T. S. Muir, secretary. The proposed constitution will be submitted to the Council of the Society at its next meeting.

## NEW BOOKS

### EUROPE.

*With Ski in Norway and Lapland.* By J. H. W. Fulton, B.A., Member of the Ski Club of Great Britain. With Introduction by G. Herbert Fowler. London: Philip Lee Warner, 1911. *Price 5s. net.*

Mr. Fulton, who has toured on ski in various European countries, here gives an account of a journey from Freiburg in Germany to Christiania, Bessheim,

in the Jotunheim Mountains and Tromsö, and thence by Narvik into Swedish Lapland. The tour was undertaken during the months of March and April, thus allowing the famous ski-jumping competitions at Holmenkollen to be witnessed. An interesting notice of this event is given. In addition to the actual account of his tour the author deals with the Elk and Reindeer, and does not forget the Lapps themselves. The *ski-löber's* vocabulary, including the pronunciation of the word "ski," is also touched upon, together with such matters as snow-blindness, one or two sticks, or none at all. Mr. Fulton evidently had no opportunity of gleaning fresh information on the subject of the long and short ski used in conjunction. In this connection a few photographs of ski still in actual use differing from the standard Telemark type would prove interesting. The illustrations give the reader some idea of the route, and the larger ones especially are excellent.

## ASIA.

*Beyond the Pir Panjal.* By Ernest F. Neve, M.D., F.R.C.S. (Edin.) London: T. Fisher Unwin, 1912. *Price* 12*s.* 6*d. net.*

Dr. Neve is a Medical Missionary who has resided and practised in Kashmir for some twenty-five years, and this beautifully illustrated volume shows us that he is a good deal more than a missionary. He is a geologist and a botanist and an intrepid and successful mountaineer, who does not conceal his own failures, but describes with obvious enthusiasm and enjoyment his ascent of such grand peaks as Haramouk and Kalahoi. The secret of his success in his profession lies in his generous sympathy and affection for the natives with whom he comes in contact. He is no bigot. He understands and makes due allowance for the vehement and often harassing opposition which he meets. Strong in his own faith and conviction of ultimate success, he hails with legitimate satisfaction the various signs that Christianity is making real if somewhat slow progress where he is at work. During his long service he has travelled north and east, even beyond Leh, and he was fortunate in seeing the famous Lama Devil Dance at Hemis. This has often been described, but Dr. Neve's description is quite as detailed and interesting as any we have seen. Interspersed over the book are many quaint and amusing legends and fairy tales. A keen observer, Dr. Neve has much to tell us about village life and the habits and customs of the people, none of it very new, but still very interesting, because told with the verve and confidence of an eyewitness. It is pleasant to hear from one so well qualified to judge that the days of oppression and apathy are gone for ever, and that in the hands of a vigorous and enlightened administration the material prosperity of the beautiful country is now assured. Naturally, and indeed inevitably, Dr. Neve places great stress on the need of moral improvement; and in this connection he bears eloquent and generous testimony to the splendid educational work that is now going on amid many difficulties and hindrances. Indeed his concluding chapters on this subject are among the best in the book. Many of the photographic illustrations are of exceptional merit.

*The Unvarying East.* By the Rev. E. J. Hardy, M.A. London: T. Fisher Unwin, 1912. *Price* 7*s.* 6*d. net.*

In this work we have an interesting and voluminous compilation of notes or sketches in which incidents, customs, manners, etc., referred to in the Bible are brought alongside of incidents, customs, manners, etc. still prevailing in the un-

varying East, and now noticeable by any observant traveller in the Holy Land, Egypt, China, etc. The book is well illustrated, and will unquestionably be of much assistance to those who are studying the Bible.

## AFRICA.

*Land and Peoples of the Kasai: Being a Narrative of a Two Years' Journey among the Cannibals of the Equatorial Forest and other Savage Tribes of the South-Western Congo.* By M. W. Hilton-Simpson, F.R.G.S., F.Z.S., F.R.A.I. London: Constable and Co. Ltd., 1911. *Price* 16*s. net.*

This work may be described as the personal side of an expedition in the Congo region, the scientific results of which as regards ethnography and natural history are elsewhere recorded. It is well written and teems with interesting information and incident.

The party ascended the Congo to Stanley Pool and thence passed up the Kasai river in many parts half a mile or more in width, and the Sankuru river, the latter part of the voyage including twenty-three days in a small steamer. Following upon this many journeys were made by land and water, the entire expedition covering some two years. There are no tales of atrocities, and the Congo officials are uniformly spoken of with respect. The same cannot be said of some of the native tribes. The Bankuru for instance are cannibals and will stalk and shoot men for food, even when the country around them abounds in game. In the same district a Chef de Poste entering a deserted village was attracted by the sound of a child crying. He was on the point of lifting it up when a string was noticed attached to the child, and on examination he discovered a bow with poisoned arrow set in the bushes to which the child was attached as bait.

The party traversed one stretch of country never before seen by white men, and they owed this success mainly to their resourcefulness and familiarity with native ideas, though even these might have failed had it not been for their possession of a mechanical toy elephant which passed as a fetish, and on at least one occasion saved the lives of the whole party. Other tribes, even living in close proximity to the Bankuru, showed a far different character, though even then such minor difficulties arose as being asked by two of the young bucks to decide which of them was the better-looking. The most interesting tribe was the Bushongo, the chief of which is the one hundred and twenty-first ruler of his dynasty, and from whom, with much diplomacy, they obtained certain ancient statuettes, one representing his most famous ancestor, and showing a marked resemblance to his own features. This people possessed intellectual abilities above the average, and quite accepted the idea that their tribal possessions and history ought to find a home in the British Museum. They regretted indeed that much was already being lost to them as the generations passed.

Part of the country traversed was open but a great part almost impenetrable forest, and "one is always tired in the forest." The forest it was found was extending its area. In that equatorial region the rainy season continues practically all the year round, and the damp is such that a gun left uncovered in the tent will become red with rust in twenty-four hours. The climate and privations it is to be feared have left their mark upon the travellers, but the work they have accomplished is admirable. Two animals new to science (an antelope and a buffalo) have received Mr. Simpson's name. Photographs and some excellent water-colour drawings add to the attraction of the book.

*Through Timbuctu and Across the Great Sahara.* By Captain A. H. W. Haywood, F.R.G.S., Royal Artillery. London: Seeley, Service and Co., 1912. *Price* 16*s. net.*

Leaving Freetown in January 1910, the author started on his long journey across north-west Africa *via* Timbuctu to Algiers. After proceeding two hundred miles by railway, he reached by a march the rock, near the source of the Niger, which marks the Anglo-French frontier separating Sierra Leone from French Guinea. On 22nd January he came to Faranah, containing two thousand natives and two Frenchmen, and stayed with the French District Commissioner, who was most hospitable and courteous. On the Mafu River he shot big game, and then continued to Kurussa, which will soon be reached by railway of four hundred miles from the coast port of Konakray. The Niger is more or less navigable from Kurussa, where the French officials have a fine garden stocked with almost every European vegetable. At Kankan he remarked that every native was collecting rubber for sale, the rubber vine growing profusely. By means of signals on drums, whereby messages are carried a great distance, the author arranged for hunters to be awaiting him, and he then shot hippopotami and hartebeest.

Captain Haywood reached Bamako on the Niger, a fine large French town, the capital of the Upper Senegal and Niger colony, with no less than fifteen trading firms. The Lieut.-Governor was most obliging, and gave the author permits to shoot. He then went on by railway to Kulikoro, and proceeded by the Niger Navigation Service to Kabara, the port of Timbuctu. Timbuctu is remarkable for being a town alone in the desert, and, except for its three eleventh-century mosques, presents an ordinary appearance. There are the houses of most of the celebrated explorers, beginning with Major Laing, who made an adventurous journey in 1820, from Morocco to Timbuctu through the Sahara; also that of Barth, who travelled here and back from Tripoli in 1850; also that of Lenz, an Austrian, who journeyed from Morocco to Dakar in 1880. Timbuctu was the capital of a great black empire till the Moorish invasion in 1482, the Moors being afterwards driven out by the Tuaregs, and the latter by the French at the end of last century. Timbuctu was the centre of the traffic in slaves. Now its chief trade is salt, brought by caravans from the desert mines of Tandeny, three hundred miles north. The only domestic animals seen in the town are camels, horses, and donkeys, there being no grazing for cows, sheep, or even goats. The author sailed down the Niger to Gao, and prepared for his journey of nearly a thousand miles across the Sahara to Biskra, a feat he accomplished in seventy-five days. His remarks on how to prepare for a desert journey and how to manage camels (one of which he rode) will be useful to travellers, while his adventures in the Sahara will appeal to all readers of this well-written and well-illustrated book.

*Alone in West Africa.* By Mary Gaunt. London: T. Werner Laurie, 1912. *Price* 15*s. net.*

In her first chapter Mrs. Gaunt tells us the origin of this remarkable book. She is one of an Australian family, of whom she says, "I cannot remember when any one of us would not have gone anywhere in the world at a moment's notice." She lost her husband soon after her marriage, and finding herself with only thirty pounds a year, she decided on adopting literature as a profession, and came to London, where she wrote stories about West Africa. In due time she was able to realise a strong wish to see West Africa for herself, and her publisher commissioned her to write a book about the old forts along the shores of the Gold Coast. She sailed up the Gambia river, touched at Sierra Leone, visited Monrovia in Liberia, worked

her way to Half Assine on the French border, and thence all along the coast to Accra. From there she proceeded north to Dodowah, and past the famous fetish Krobo hills to Akase on the Volta river. From thence she marched to Ho on the German frontier and on to Palime, where she found the railway which took her to Tome on the coast. Here she turned west and marched to Keta, "the hottest place on the West Coast," whence she sailed to Addah, in leaving which town she was nearly wrecked in crossing the bar, thence to Accra and Sekondi. From Sekondi she went by rail to Kumasi, visiting *en route* the goldfields of Tarkwa and Prestea; and from Kumasi she marched to Sunyani, the heart of the rubber country. Odumaso, some five miles from Sunyani on the Ashanti border, was the furthest point of her expedition, in which she spent some nine months, and in which she had not a few thrilling adventures and hairbreadth escapes. She went to various places where a white woman had never been before; and from her own description of her adventures we imagine she would advise that no white woman should ever go again alone and unprotected. The principal charm of the book will be found in the courage and unconventionality of the writer, who seems to have been quite well aware of the dangers she ran, but she had made up her mind to carry the things through, and she did so. There is no attempt at sensational or fine writing, and very little at moralising. A Creole doctor at Sierra Leone said to her "Write about what you see, and if you do not understand what you see then ask until you do," and she has very wisely adopted his advice. Mrs. Gaunt's tour was what may be called a hurried scamper over hundreds of miles of uncivilised West Africa, and her observations and impressions cannot have the weight which is justly attached to the views of those who have had long and mature experience of the places and peoples they describe. But it is interesting to find that her impressions, say of Freetown in Sierra Leone or of Monrovia in Liberia, confirm what has been already set forth about these places by such distinguished administrators as Mr. Aldridge and Sir Harry Johnston. Mrs. Gaunt is never dogmatic. She is conscious of her limitations, but knowing the value justly given to the observations and criticisms of an unbiassed eyewitness, she has the courage of her opinions, and does not hesitate to challenge the present British policy, say, of cutting down trees wholesale with the view to exterminate the nuisance of mosquitoes, or of constantly shifting officers from one place to another, thereby preventing them from taking an interest in their work, or acquiring a really thorough and useful knowledge of the country and people: and she denounces the generally accepted theory that Englishwomen cannot live on the West Coast. Wherever she went she had a most hearty welcome from natives and Europeans, a welcome which she loses no opportunity of cordially acknowledging; and in the course of her travels she met a strange assortment of human beings, varying from gentlemanly and otherwise) savage chiefs to gentle, unsophisticated French nuns, and she had no difficulty in ingratiating herself with them all. Her opinions regarding missions are not as yet likely to find general acceptance. Like other travellers she is sanguine of a great future for West Africa. We must add that this interesting book is profusely illustrated with excellent photographs.

*Trekking the Great Thirst.* By Arnold W. Hodson. London: T. Fisher Unwin, 1912. *Price* 12*s.* 6*d. net.*

Yet another volume on big game sport in Africa! The author, Lieut. Hodson, describes with simplicity and enthusiasm various expeditions he has made in the Kalahari Desert since he joined the Bechuanaland Police in 1904, and his descrip-

tions thoroughly justify the title of his book, *Trekking the Great Thirst*. His duties as a police officer were various, such as collecting the hut-tax, arranging for the detention and movements of refugees from Damaraland, selecting a site for the residence of a deposed chief and his followers, and the like; and he had to trek through hundreds of miles of desert, through parts of which the only food procurable for himself, his followers, and his animals was melons. He is a true sportsman, who records with unmistakable enjoyment and glee his successes, but who also never hesitates to tell of his own failures. He was successful in making a fine collection of specimens of thirty different varieties of big game, and he had many thrilling adventures of the style to which we are accustomed in the works of that mighty Nimrod, Mr. F. C. Selous, who, on a perusal of this work in manuscript, vouches for it as modest and truthful. Still more valuable is the encomium of Lieutenant Hodson's former chief, Sir Ralph Williams, who says, "He has been my right-hand man in most difficult expeditions and services in the Kalahari Desert, and in the Protectorate generally, and his utter fearlessness, his endurance, his cheery manner under difficulties, his readiness to carry out orders, no matter how difficult, his absolute inability to recognise failure, and his determination to achieve success, have gained me, as his former chief, credit and honour which I most willingly share with him." A perusal of the book will convince our readers that this eulogium is well deserved. We must add that the book is profusely illustrated with photographs, many of them of considerable merit.

*Meroë, the City of the Ethiopians.* By JOHN GARSTANG, D.Sc., M.A., B.Litt., Rankin Professor of the Methods and Practice of Archæology in the University of Liverpool. Oxford: The Clarendon Press, 1911. *Price* 31*s.* 6*d. net.*

In this interesting volume we have the results of the work of the first season (1909-10) of the expedition sent by the Liverpool University Institute of Archæology under Professor Garstang to excavate the site of the ancient city of Meroë, once the capital of Ethiopia, or the land of Cush, now known to us as the Sudan. It was situated between the Atbara and the Blue Nile, and was once an important city, supporting, according to Pliny, an army of over 200,000 men, and ruled by Queen Candace, one of a dynasty of forty-four queens, all of the same name. Obviously Pliny's account cannot be accepted as accurate, and Professor Sayce, whose authority as an Egyptologist is second to none, has contributed an interesting introductory chapter to this book, in which he sets forth what can be safely gathered from the mists of tradition and history as to the real truth about Meroë. Professor Sayce was present during a considerable part of the time of the excavations, and has contributed another chapter on the decipherment of Meroitic Hieroglyphs. From him we learn that already the expedition has discovered certain new inscriptions which have enabled him "to determine the values of several of the letters in the Meroitic hieroglyphic alphabet. They also show that, in addition to the letters, a certain number of characters were used as ideographs and determinations, at all events in the earlier period of the Meroitic script, and that it was only by degrees that the native hieroglyphic script became purely alphabetic." The excavations are described by Professor Garstang. The principal were the temples of Ammon and Isis, the lion temple and the sun temple, and part of the necropolis. The work of editing the new inscriptions was assigned to Mr. Griffiths of Oxford University. The photographs and plans are excellent. The Liverpool University and Professor Garstang are to be heartily congratulated on the success of the first season's work, which undoubtedly entitles them to expect even more brilliant results as the work of excavation proceeds.

## AMERICA.

*Forest Physiography.* By Isaiah Bowman, Ph.D. New York : John Wiley and Sons, 1911. *Price* 21*s.*

This work owes its origin to the demand for "a guide to the topography, drainage, soils, and climatic features of the United States," and the author is to be congratulated upon the production of a very complete and exhaustive volume.

We heartily agree with him when he says, "It seems so clear that one cannot know forestry without knowing under what physical conditions trees grow," and again, "It would seem that one should pay a great deal of attention to lumbering as related to drainage and relief, to silviculture as related to soils, climate, and water supply, and in general that one should emphasise the forester's dependence upon physical conditions."

The first part of the book deals very thoroughly with such matters as the origin, diversity, physical features, water supply, temperature, and chemical features of soils. Part II., on the physiography of the United States, contains a detailed account of the natural regions of the country such as the Cascade and Sierra Nevada Mountains, the Pacific coast valleys, and the great plains, the features of each division being emphasised as regards extent and origin, topographic features, climate, soil, and vegetation, etc., etc. "Soil class, soil type, and soil series" are dealt with in the appendix, and an outline is given for a survey in forest physiography which should be of great value to the less experienced forester. Soil class is the name given to the grouping of soils according to texture—that is according to the relative proportions of the particles of different sizes which they contain. When large areas are under consideration soil types are distinguished. Thus two soils may have the same texture, but be markedly unlike as regards chemical composition and fertility. In working in a very large territory, such as the whole of the United States, it has even been found necessary to recognise still larger groups or soil series.

The book is sumptuously illustrated with nearly three hundred photographs, diagrams, and maps, some of the latter being coloured and illustrative of the zonation, physiography, and geology of North America.

*Sport in Vancouver and Newfoundland.* By Sir John Rogers, K.C.M.G., D.S.O., F.R.L.S. London : Chapman and Hall, Ltd., 1912. *Price* 7*s.* 6*d. net.*

In this well-illustrated volume we have the record of two sporting expeditions, one, in 1908, in Vancouver, and the other, in 1910, in Newfoundland. So far as big game is concerned neither expedition was remarkably successful. In Vancouver, however, on the Campbell River, the fishing was such that any disciple of Walton might envy. In twenty-eight days Sir John caught 221 fish of an aggregate weight of 2826 lb., two of them being salmon weighing respectively 58 and 56 lb. The shooting in Vancouver was spoilt by two accidents, which partially disabled Sir John himself and his best hunter, Cecil Smith. The weather also was atrocious, rendering marching and camping in the forest equally difficult and uncomfortable. The expedition in Newfoundland was not marred by any accident, but Sir John had singularly bad luck, seeing a fair number of cariboo, but not coming across any with good heads. By the laws of Newfoundland the licensed sportsman is allowed to shoot only three stags in one season, so naturally he is in no hurry and makes a deliberate selection. Notwithstanding much patient and arduous stalking in difficult country, Sir John got only ordinary heads. The book is embellished with many excellent photographs, and some clever original drawings by the author.

*Panama: The Canal, the Country, and the People.* By ALBERT EDWARDS. New York: The Macmillan Co., 1911. *Price* 10*s.* 6*d. net.*

*Der Panamakanal: Die Bedeutung des Kanalbaus, seine Technik und Wirtschaft.* Von Dipl. Ing. MAX FIEGEL. Berlin: Dietrich Reimer, 1911. *Preis M.* 14*s.*

Who Albert Edwards is we do not know, but we have to thank him for a very pleasant time spent over his book. A more informative account of canal, country, and people would be difficult to find in anything like the same compass, and for the "atmosphere" of the book one would search elsewhere in vain.

Chapters i.-ix. contain a fine description of what a visitor sees on the way to and on his arrival at the scene of operations. There is a breeziness in this part of the book that makes it difficult to stop reading. Nothing comes amiss—landscapes and seascapes, natives, houses, foreigners, innkeepers, travellers—all appear in the narrative, and the frankness and sanity of the descriptive writing make the chapters very attractive.

Chapters x.-xxviii. pp. 130-474, contain a digest of the history of the region, culled from all sources, Robertson, Washington Irving, Prescott, and later official papers.

Chapters xxix.-xxxiv. return to the work on the canal, and present an admirable picture of the work done, the men who do it, the conditions of life prevalent. Altogether, one can understand and sympathise with the author when he says over and over again, "Think of that for a minute, and then be proud that you are an American."

The other is a book of a different kind, and appeals to a different audience. It is the work of a practical engineer, who was naturally attracted by the opportunity of studying the engineering problems illustrated in the work of "digging the ditch." The nature of the problems to be solved, the difficulties to be overcome, the various kinds of machinery best adapted for the various purposes, are all discussed here, with intelligent appreciation. The plans and photographs of the dredgers and diggers employed in the work are very clear and full of interest.

## AUSTRALASIA.

*My Adventures among the South Sea Cannibals.* By DOUGLAS RANNIE. London: Seeley, Service and Co., Ltd., 1912. *Price* 16*s. net.*

Early in the last decade of the last century, the abuses and cruelties which had become notorious and seemed unavoidable in the native supply of labour from various groups of islands in the Pacific to Queensland, had given rise to a general revulsion of feeling against the existence of the traffic, and this was materially aided by the growth of the feeling against the allowing of any coloured race to settle in Australia. At any rate, in 1904, the Polynesian labour traffic came to an end once and for all. In this well-illustrated volume we have the reminiscences of one of the agents appointed by the Queensland Government to superintend the traffic in the year 1883. In one sense, of course, what the writer tells us may be considered ancient history, and as the objectionable traffic no longer exists, it has to some extent lost interest. But the book is well worth perusal, as it sets forth from the pen of one who took a principal part in them a series of strange adventures and doings among peoples and tribes, of whom, probably, it is not too much to say that they were, and for that part are, among the most degraded in the world. We refer to the inhabitants of the Solomon Group. It was Mr. Rannie's business to go with the ships, which on the one hand took return emigrants back to their homes, and on the other brought back bands of emigrants who were willing to work in Queensland; and it was his duty to see that the return emigrants were

set down in their own islands with all their property, and that recruits were not decoyed from their homes on false pretences, or carried off by fraud or violence. It was a risky business from start to finish. The ships employed in it were by no means first class. They had to lay their account for terrific storms, dangerous tides, imperfectly charted courses, and the like. At many places which they visited, malaria and disease were rampant, and the natives with whom they had to deal were generally treacherous, and, literally, bloodthirsty cannibals. To all those who are fond of exciting tales of strange adventures by sea and land, we can recommend this work as calculated to provide ample amusement and interest for them, although the tales are of bygone days. Mr. Rannie has a good word to say for some of the inhabitants of the Solomon Group, but, as a rule, they seem to have merited the description we have given of them.

## POLAR.

*Chasses et Chasseurs Artiques.* Par le Duc d'Orléans. Paris: Plon-Nourrit et Cie, 1911. *Prix* 4 *frs.*

*Hunters and Hunting in the Arctic.* By the Duke of Orleans. London: David Nutt, 1911. *Price 7s. 6d. net.*

There was certainly room for an authoritative volume on the game and fur animals and the hunters of the Arctic regions, but it may be questioned if this volume by the Duke of Orleans has filled the gap. There are chapters on the hunters, the bears, reindeer, walrus, and seals, and incidentally information about some of the birds. No doubt there is much information in the book, but it is by no means exhaustive of the amount of material available for such a work. The personal note is dominant throughout, and we weary a little of tale after tale of ruthless butchery interspersed with regrets at the virtual extermination of many of the species. Hunting is ceasing to be a profitable occupation at Spitsbergen and other Arctic lands, and the numerous wintering parties that frequent these lands will probably be abandoned in future. It is time that some definite political ownership by a strong power was established in these lands if only to prevent this wholesale exploitation by hunters and would-be sportsmen alike. However, it is pleasant to think that the game which remains will escape commercial enterprise, at least for some years.

A valuable chapter in the book is that on the trappers, where the author gives an account, brief but graphic, of his visit to Jan Mayen in 1910. Even this meagre information about that seldom visited island is welcome.

The English rendering is very literal, and too obviously bears the stamp of a translation: in some passages it is far from graceful. The translator seems unaware that Ice-fjord is a proper name, and he persists in the old but erroneous spelling of Spitsbergen.

Both volumes contain a number of illustrations, few of which are of special merit, but neither edition has an index.

*Campagne Arctique de* 1907. Par le Duc d'Orléans. Bruxelles: Charles Bulens, 1911.

The first results of the Duke of Orleans' expedition in 1907 to Novaya Zemblya and the Barentz Sea have taken some time to appear, and have not been published as quickly as those of his 1905 expedition to the Greenland Sea. Two parts are now published dealing with physical work and deep-sea deposits, and also containing the log of the *Belgica* and a number of excellent photographs,

and two maps. The expedition carried a biologist, so that we hope some zoological results will be forthcoming, although there seems to be no mention of deep-sea dredging in the log. Meteorological observations were taken hourly during the three months' duration of the voyage in Arctic Seas. Owing to the shortness of the period the value of these observations will lie chiefly in their correlation with other contemporaneous ones in subarctic regions. The observations in atmospheric electricity are valuable, if only because of their rarity in these regions. The discussion of the deep-sea deposits by M. Thoulet is most detailed and emphasises the uniformity of the deposits in the polar basin, chiefly mud with little real sand or calcareous matter.

The results are well printed and adequately supplied with maps, a quality not always apparent in such publications.

## GENERAL.

*Traité de Géologie.* Par Émile Haug. Vol. II. Fascicule 3. Paris: Armand Colin, 1911. *Prix* 11 *fr.*

In a memoir on geosynclinals and continental areas published in 1900 by the Geological Society of France, Professor Haug of the University of Paris discussed the cause of the alternate advance and retreat of the oceans in relation to the continents. He showed that the great marine transgressions, by which the continental areas have often been submerged, occur simultaneously in both hemispheres, and also occur simultaneously in the polar and equatorial regions; but he holds that they are not universal throughout the globe. He therefore differs from the conclusion of Professor Suess that the emergence and submergence of the lands is due to variations in the level of the ocean. Professor Haug stated his conclusions as a geographical law to the effect that whenever a member of a sedimentary series transgresses upon a continental area it also shows a movement of regression in the geosynclinals; and reciprocally that whenever such a member transgresses in a geosynclinal it retreats from the continental areas.

Professor Haug has now published a valuable treatise on geology which has appeared in parts between 1907 and 1911. (See previous reviews, xxiv. p. 219, xxv. p. 389, xxvii. p. 55.) The first volume describes geological phenomena, and deals with the physical forces that act as geological agents. The remaining three parts, forming the second volume, are devoted to an account of the successive geological systems. The first volume is of most geographical interest; the second is the more original, as it presents a full summary of stratigraphical geology written in accordance with Professor Haug's law.

The work is of great value to British geologists as a summary of current French opinion on stratigraphy and from its full account of the geology of western Europe and the Mediterranean basin. It includes references to other parts of the world, but they are naturally less complete.

Thanks to the great advances made in recent years it is now possible in describing the geological systems to subdivide them geographically according to their bathymetric characters as well as their distribution. Professor Haug's classification presents many important departures from that generally accepted by British geologists. Thus in his treatment of the post-Cretaceous formations he abandons the usual division into five systems, Eocene, Oligocene, Miocene, Pliocene, and Pleistocene, and divides them into three groups, the Nummulitic, Neogene, and Quaternary. The divisions between these groups do not correspond with those of the usually accepted systems, for the Neogene includes the upper part of the Oligocene and the lower part of the Pliocene. Professor Haug's text-

book will be of especial value from its detailed treatment of Palæogeography, and amongst other of its attractive features are its numerous excellent illustrations.

*Forecasting Weather.* By W. N. Shaw, F.R.S., Sc.D., etc., Director of the Meteorological Office, London. Fully illustrated with Maps, Charts, and Diagrams. Pp. xxviii + 380. London: Constable and Co., Ltd., 1911. *Price* 12*s.* 6*d. net.*

It is now nearly thirty years ago since the Hon. Ralph Abercromby formulated in considerable detail the general principles underlying the problem of forecasting the weather by means of synoptic charts. The principles as enunciated by him were almost purely empirical, representing the outcome of long experience, and since his day no general restatement of the problems involved or the methods to be followed has been attempted, until the publication of this book from the pen of the distinguished Director of the Meteorological Office. It will be admitted readily that in practice the actual work of the forecaster, conducted at high pressure as it necessarily is, becomes largely a matter of routine, and doubtless a man of experience with his working charts before him acts to a large extent subconsciously in the framing of his forecasts. With the whole routine Dr. Shaw has become intimately familiar since he came to take charge of the Meteorological Office in 1900, but he came bringing with him the experience of twenty years' work at the Cavendish Laboratory at Cambridge, and it was therefore natural for him to "watch the routine from the point of view of experimental physics." The book, therefore, has a quite special value, and will, we feel, do much to advance the cause for which its author has strenuously laboured, that of securing a more serious consideration for meteorology at the hands of scientific workers in this country. It must further be pointed out, that some of the most valuable parts of the book are based on researches made by Dr. Shaw and some of his colleagues. His own work, along with Lempfert, on *The Life History of Surface Air Currents*, is of great importance, and forms the basis of Chapter vii., whilst the following chapter describes the investigations of Lempfert and Corless into the nature and movement of "line-squalls."

Where much is excellent, the outstanding chapter is chapter vi. (pp. 142-183) which discusses the "Physical Processes of Weather." What we may call the major movements of our atmosphere, such as the trade winds, are readily understood, and the normal state of the atmosphere may be regarded as one of a steady state of circulation and by no means as one of rest. But the weather changes which are superimposed on the normal state are extremely complex, and to explain in simple language the fundamental thermodynamical relationships involved was a task of extreme difficulty which Dr. Shaw has accomplished in an admirable manner. If the mixture of gases which compose our atmosphere were free from moisture, the thermodynamical problems would be simple, but the presence of water vapour renders them extremely complicated. Consider, for example, the enormous amount of latent heat set free when water vapour condenses into rain. We would earnestly recommend this chapter to the attention of students, and would advise certain "popular" authors to revise their work in the light of it. There is much loose writing, for example, on the causes of rainfall, and it should now be recognised that when a mass of air is somehow raised, whether by a convection current or because the wind has been deflected upwards by a hill or mountain, the cooling of the air and consequent condensation from it is due to the fact that the air has lost heat in the process of expanding in consequence of the diminished pressure to which it is subject at higher levels.

The earlier chapters (i.-v.) deal with synoptic charts ; the relations of wind, temperature and general weather to the distribution of barometric pressure ; types of weather ; and local weather in relation to weather types. We note that Dr. Shaw considers that the general principles as set forth by Abercromby—they are quoted verbatim and at great length—are sound and still hold good. After chapter v., chapters vii. and viii. should be read, and then perhaps chapters xiv. and xv., which deal with some suggestions by Guilbert, a French meteorologist. The fundamental problem for the forecaster is that of anticipating the approaching changes in pressure distribution, and in particular any warning of the approach of a new depression, or any indication of the probable track of a depression, which has already been identified, is of great importance. Though Guilbert has formulated certain rules for guidance in these difficult problems, and has himself proved a successful forecaster, professedly on the basis of these rules, Dr. Shaw appears to doubt whether other workers would have an equal success.

The remaining chapters of the book, ix.-xiii. and xvi.-xviii., are easier reading than those we have already referred to, and deal chiefly with various matters of direct practical interest, such as colliery warnings and forecasts for agriculturists. Incidentally, it may be noted that the colliery warnings which appear from time to time in the public press are not issued by the Meteorological Office. Nor are the "Three Day Forecasts," though recently the official forecasters have committed themselves to an indication of the "Further Outlook" beyond the twenty-four period to which the ordinary forecasts apply when such an "outlook" appeared unmistakable on the basis of the information set down on the Synoptic Charts. There are many other points of interest to which we should like to have referred had space permitted, such as the problem of the "travel" of weather systems across the Atlantic ; the employment of wireless telegraphy in extending the area placed under observation ; and the possibility of successful upper-air forecasts for aeronauts.

Throughout the book, the experience of the Meteorological Office is mainly drawn upon, and one result of its publication will be to increase the already great respect in which the work of that office is held by those whose opinions are of value. As we have indicated, both the scientist and the practical man will find pleasure in the book, and the wealth of diagrams and maps with which it is illustrated make it peculiarly attractive to the student. Most of the maps are excellently reproduced, but in one or two the reduction from a large original has been so great, that it is difficult to make out points of detail even with the aid of the magnifying glass which Dr. Shaw himself suggests in his preface. But the general get-up is excellent, and fully worthy of the importance of the contents of the book.

## BOOKS RECEIVED.

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*Illustrated Catalogue of the Anthropological Museum, Marischal College, University of Aberdeen.* By R. W. Reid, M.D., F.R.G.S. Demy 8vo. Pp. viii + 357. *Price* 1*s.* Aberdeen : University Press, 1912.

*Catalogue of Specimens Deposited by Sir Wm. MacGregor, G.C.M.G., M.D. (Aber.), etc., in the Anthropological Museum, Marischal College, University of Aberdeen,* 1899-1909. Aberdeen : University Press, 1912.

*Brown's Nautical Almanac: Harbour and Dock Guide and Daily Tide Tables for* 1912. Edited by JAMES R. BROWN. Assisted by H. B. GOODWIN. Demy 8vo. Pp. 589. *Price* 1*s.* 6*d. net.* Glasgow: James Brown and Son, 1912.

*The Cape of Adventure: Being Strange and Notable Discoveries, Perils, Shipwrecks, Battles upon Sea and Land, with Pleasant and Interesting Observations upon the Country and the Natives of the Cape of Good Hope.* Extracted from the writings of the Early Travellers by IAN D. COLVIN. With Numerous Illustrations. 4to. Pp. xxix + 459. *Price* 10*s.* 6*d. net.* Edinburgh: T. C. and E. C. Jack, 1912.

*Book of the Knowledge of all the Kingdoms, Lands, and Lordships that are in the World, and the Arms and Devices of each Land and Lordship, or of the Kings and Lords who Possess them.* Written by a Spanish Franciscan in the middle of the fourteenth century. Published for the first time with Notes by Marcos Jiménez de la Espada in 1877. Translated and Edited by Sir CLEMENTS MARKHAM, K.C.B. Demy 8vo. Pp. xiii + 85. London: Hakluyt Society, 1912.

*The Secret of the Pacific: A Discussion of the Origin of the Early Civilisations of America, the Toltecs, Aztecs, Mayas, Incas, and their Predecessors; and of the Possibilities of Asiatic Influence thereon.* By C. REGINALD ENOCK, F.R.G.S. With 56 Illustrations and 2 Maps. Demy 8vo. Pp. 359. *Price* 12*s.* 6*d. net.* London: T. Fisher Unwin, 1912.

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*Northamptonshire.* By M. W. BROWN, M.A.
*Oxfordshire.* By P. H. DITCHFIELD, M.A., F.S.A.
*Worcestershire.* By L. J. WILLS, M.A., F.G.S.
*Huntingdonshire.* By Rev. W. M. NOBLE.
*Carnarvonshire.* By J. E. LLOYD, M.A.
*Buckinghamshire.* By A. M. DAVIS, D.Sc., F.G.S.

Maps, Diagrams, and Illustrations. Cr. 8vo. *Price* 1*s.* 6*d. each.* Cambridge: University Press, 1912.

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*Palestine and Syria: With Routes through Mesopotamia and Babylonia and the Island of Cyprus.* Handbook for Travellers. By KARL BAEDEKER. With 21 Maps, 56 Plans, and a Panorama of Jerusalem. Fifth Edition. Remodelled and Augmented. *Price* 14*s. net.* Leipzig: Karl Baedeker, 1912.

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Post 4to. Pp. xv + 210. *Price* 10*s.* 6*d. net.* London: T. Fisher Unwin, 1912.

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*Corals and Atolls: A History and Description of the Keeling-Cocos Islands, with an Account of their Fauna and Flora, and a Discussion of the Method of Development and Transformation of Coral Structures in General.* By F. Wood-Jones, D.Sc., F.Z.S., etc. Re-issue. Demy 8vo. Pp. xxiii + 392. *Price* 15*s.* London: Lovell Reeve and Co., Ltd., 1912.

*A Junior Geography of Scotland, Regional and Practical.* By David Frew, B.A. Crown 8vo. Pp. 96. *Price* 1*s.* London: Blackie and Sons, Ltd., 1912.

*The Statesman's Year-Book: Statistical and Historical Annual of the States of the World for the Year* 1912. Edited by J. Scott Keltie, LL.D. Forty-ninth Annual Publication. Revised after Official Returns. Crown 8vo. Pp. lxxxiii + 1428. *Price* 10*s.* 6*d. net.* London: Macmillan and Co., Ltd., 1912.

*From Halifax to Vancouver.* By B. Pullen-Barry. Illustrated. Demy 8vo. Pp. xvi + 352. *Price* 12*s.* 6*d. net.* London: Mills and Boon, 1912.

*The Italians of To-Day.* By Richard Bagot. Crown 8vo. Pp. vii + 248. *Price* 2*s.* 6*d. net.* London: Mills and Boon, 1912.

*A Class-Book of Physical Geography.* By A. T. Simmons, B.Sc., and Ernest Stenhouse, B.Sc. Crown 8vo. Pp. viii + 436. *Price* 4*s.* 6*d. net.* London: Macmillan and Co., 1912.

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*Publishers forwarding books for review will greatly oblige by marking the* **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

# THE DEVELOPMENT AND PROGRESS OF RHODESIA.[1]

By GERRARD DE HOCHEPIED LARPENT, B.A., Cantab.

(*With Illustrations.*)

RHODESIA is in area rather more than fourteen times the size of Scotland —only a little less than the total extent of the four colonies, Transvaal, Orange Free State, Natal, and Cape Colony. The greater part of Southern Rhodesia is a well-watered plateau, over 4000 feet above the level of the sea, as high as the topmost ridge of Scotland's highest mountain, Ben Nevis—which accounts for its splendid equable climate, with no extremes of heat and cold, salutary for European men, women, and children.

About four hundred years ago the Portuguese, who were the first European nation to settle on the South African continent, built a fortress, and established themselves at Sofala, about thirty miles south of the present town of Beira. Sofala is mentioned in the works of Milton (*Paradise Lost*, xi. 399-401), and was at that time an Arab settlement, widely known on account of its flourishing export trade in gold dust. This is especially interesting to us at the present day, because the gold shipped from Sofala was undoubtedly mined in the Hinterland now called Southern Rhodesia.

The Portuguese explored the river Zambesi, and we read in their records of a certain ill-fated expedition, under the command of Signor Francisco Barreta, against a powerful native potentate of the name or title of Monomotapa, whose principality is practically identified with the eastern portion of Southern Rhodesia. It was while he was attempting to convert Monomotapa to Christianity that the Goanese Jesuit priest Gonçalo de Silveira was cruelly murdered. His lamentable story has

[1] A lecture delivered to the Society in Edinburgh on March 21st, 1912.

earned for Rhodesia the melancholy distinction of having furnished the first martyr to the Christian cause in South Africa.

The obvious question now arises, "Why has Rhodesia not been discovered before?" The answer and explanation is readily supplied by reference to geographical principles—"Geography lies at the basis of history." South Africa resembles an inverted plate having a fringe of low-lying coast where the conditions of primitive life made European settlement wellnigh impracticable. Beyond this belt, shutting off the vast inland plateau, towers an almost unbroken range of hills, running parallel to the coastline, forming a natural barrier which defied the half-

The Sable Antelope.

hearted efforts of the unworthy nerveless successors of the once-virile Portuguese pioneers, who were daunted by the natural difficulties, and shrank from any serious encounters with the fierce native tribes of the interior. The valley of the Zambesi, the only waterway of importance, proved equally deadly and enervating to Europeans. It is easier to walk up steps than to climb a ladder, and therefore the gradual approach from Cape Town, the line of least resistance, has been the highway of advance to the north from the south.

So it was that the period of Portuguese pioneering enterprise soon died away, and it was not till three hundred and fifty years afterwards, that is fifty-six years ago, that a man of British birth penetrated into the very heart of Rhodesia. He was a Scotsman, the son of a Blantyre weaver. His name is known to every one of you and throughout the civilised world—David Livingstone. Livingstone's efforts were chiefly

spent in establishing a British outpost upon the high lands to the north of the Zambesi. The value of his foresight was sufficiently demonstrated when, in after years, the little colony proved to be a powerful factor in sustaining the British claim to access to the Great Lakes, and in securing the freedom of the river highway.

It was only about twenty-six years ago that the nations of Europe began their scramble for the partition of the African continent. We largely owe the predominant position that Britain holds to-day in southern Africa to the genius of a great Englishman, Cecil John Rhodes. Rhodes went out to the Cape to join his brother as a farmer. He soon afterwards found himself at the Kimberley diamond fields, where he amassed a huge fortune, which fortune was increased more and more by judicious investment in the great gold-fields of Johannesburg. Side by side with his commercial enterprise, he made time in which to take a degree at Oxford, and enter upon a political career, which resulted in his being nominated as Premier for Cape Colony. He was one of the few men who realised that Bechuanaland and the North held the key to the situation, and that Britain must take action without delay or else become a cipher as a South African power.

Apart from the political desirability of driving a British wedge through the centre of South Africa, reports had come down country from time to time about a wonderful irregular tableland north of the Limpopo river, where dwelt vigorous native tribes wealthy in countless flocks and herds, where big game swarmed in every valley, where white people could live and their children thrive in the magnificent climate of the temperate zone that had been carried into the heart of the tropics. Travellers had told of gold mines and old workings, and hunters in pursuit of the elephant or the sable antelope had stumbled across old ruins that belonged to a bygone age. Who the mysterious people were that once inhabited these buildings no one yet seems to know. From their knowledge of dressed stone in building, rock mining, and religious ceremonial, they may well be imagined to have been a people superior to the ordinary native tribes of South Africa. Whether the cotton plant and the wild lemon that are found in proximity to some of the ruins may be ascribed to their period is a matter for conjecture, and some stress might be laid on the fact that the natives of those parts possess more than an ordinary cunning in the working of metals. Some say that they were Arabs or Sabæans, and call to witness the name of the Sabi river and the words of the Bible, "The kings of Arabia and Saba shall bring gifts." Some adopt the fascinating theory that here was the long-sought mysterious land of Ophir, that here the Queen of Sheba held her court, and that the gold that gilded the pinnacles of the temple of King Solomon was mined in Southern Rhodesia. Others cling to the equally romantic hypothesis that the Phœnicians, perhaps as far back as two thousand years before the Christian era, may have penetrated to this distant country, those fearless mariners, who, according to the chronicles of Herodotus, circumnavigated the continent of Africa by command of Pharaoh Necho, and in later days sailed beyond the Pillars of Hercules, "beyond the sunset and the baths of all the Western stars," until they

beached their vessels upon the shores of Britain, where they discovered and developed the famous tin mines of Cornwall.

Whoever these builders were, it is certain that in a bygone age they were either annihilated, or forced to evacuate the cities, temples, or fortresses that they had constructed, wherein to collect their treasure before transporting it to the coast. Over a hundred of these ruins remain, an archæological problem to stimulate the ingenuity of the antiquarian, and to baffle the researches of the ethnologist.

Another race has left quaint traces of long centuries of occupation of the lofty tablelands of Rhodesia. The Bushmen were a pigmy

The Zimbabwe Ruins: Interior of the Elliptical Temple.

race of nomad hunters who killed their game by poisoned arrows, or trapped them in ingeniously constructed pits dug in forest paths. As a race they have almost entirely disappeared; the few who survive are of a most degenerate type. Curiously enough, although the Bushmen have sunk low down in the scale of humanity, they once possessed conspicuous artistic power. Their paintings in caves or on quartz and granite rocks occur all over Southern Rhodesia, and as specimens of primitive art show remarkable correctness of drawing, and skilful imaginative treatment. The prominent anatomical peculiarities of the natives are emphasised perhaps with satirical exaggeration, but the habit of carrying sticks swung across the shoulders can be observed in any Rhodesian village to this day.

To secure this vast Hinterland for the British people Rhodes required

the sanction of international law. He was the possessor of enormous personal wealth, and had the adherence of many wealthy supporters and also wielded political power, but these useful factors were not all-sufficient for his purpose. Judging from past experience, the British nation were not likely to bestir themselves to acquire further extension of territory in South Africa, so that if expansion was to take place, the motive power must be from individual effort. The history of the acquisition of the Indian Empire by a commercial company bearing a charter from the British sovereign suggested the machinery of the British South Africa Company. The first step towards obtaining a charter from the throne was to get the sanction of the nominal lords of the soil, the chiefs of the native tribes. Of these the most powerful was Lobengula, the ruling monarch of the fierce Matabele—who held sway at Bulawayo (pertinently named The Place of Slaughter), and to his headquarters Rhodes despatched a handful of his most trusted friends, among whom was the clever young Kimberley physician, Dr. Jameson, to obtain the concession of the mineral rights in Mashonaland, whose people were tributaries of Lobengula. Fortunately the embassy arrived at a time when Lobengula had a bad attack of gout, and the monarch, being specially grateful and affable to Dr. Jameson, who effected his cure, signed the concession. Armed with this document, Rhodes went to England, and finally obtained the imperial sanction for the formation of the Chartered Company.

To occupy the country under the eyes of 150,000 warlike savages was a perilous undertaking, and the first move made by the Chartered Company was to raise a force of pioneers to make a road, establish forts, and protect white settlers. Their objective was a fine plain, where the town of Salisbury now stands, situated nearly 1000 miles from the terminus of the Cape railway, and about 5000 feet above the sea-level. All baggage had to be conveyed by wagons and oxen. The ox-wagon has been proved to be invaluable to the pioneer settler, for crossing rivers and going anywhere across country. The Dutchmen make their wagons their home, and travel immense distances in this way, and in those days took a facetious delight in calling the worst animal in the span "Englishman" or "Roinek" (red neck), so that they might have an excuse for belabouring him as often as possible.

Mr. Rhodes used to travel in state with a light wagon and a span of mules, and indulged in the luxury of a table, a chair with a hole in the back of it, a flannel shirt, and an old hat.

It is difficult for us, living in a civilised country, to imagine that journey of the pioneers. Here in every city we have great main thoroughfares, and even in the moorlands we are accustomed to well-defined tracks. But the pioneers had not even tracks to follow, and the leading files of the column found themselves often plunging in grass far above their heads. The grass in Rhodesia, like the natives and many other things in the life of the settler, it may be observed, when first met with is an obstruction, but afterwards proves to be a blessing in disguise. The country is now in what may be described as an "untamed state," but the natural fertility, which supports annually a crop of such luxuriant

wild grass, is so great that, with careful grazing-down of the present herbage and the gradual introduction of valuable European and American grasses, as well as the preservation of the rich native grasses, which abound everywhere, in the course of comparatively few years many areas in Rhodesia should become as rich as any pastoral land in the world.

The pioneers, arrived at Salisbury, were disbanded and spread over the country, prospecting and preparing to settle down on the land. A post service was established, which was followed a few months later by a telegraph line, for which most of the iron sockets and poles were cast in Glasgow.

In constructing their homesteads the white settlers had perforce to avail themselves of the materials that lay to their hands, and built huts with the help of the natives, in native fashion, but of a more permanent and comfortable style. These huts have not a nail in them; the walls are made with bush poles placed close together and smeared over with clay, the rafters are tied up with strips of bark, and an excellent substantial thatch can rapidly be laid on by using the long native grasses. The pioneers had no bill to pay for builders' materials, for their whole expense was the labour of construction. The same conditions obtain to-day, and the cheapness and ease of creating a temporary camp is an important economic consideration. The man going out to farm finds building requisites provided for him on his own land, and merely has to pay a gang of natives for their work. This style of primitive homestead costs only a trifle, is easily renewed and repaired and, provided that the bedrooms are made mosquito-proof, serves its purpose until the farmer is in a position to attempt the greater task of making and burning his own bricks, with which to build substantial barns and a permanent home. But the man who goes out to Rhodesia to-day, although he undoubtedly has many difficulties to overcome, happily has but few in comparison with the troubles that beset the earlier pioneers, of whom many found "everything advantageous to life save means to live." Troubles came not as single spies, but in battalions; cut off from civilisation by some hundreds of miles, they were subjected to every kind of discomfort, including a call to arms. The young warriors at Lobengula's headquarters, Bulawayo, complained that, like Othello, their occupation was gone. "The pomp, pride, and circumstance of glorious wars" (which consisted in butchering the luckless Mashona men and carrying off their women and cattle) was gone. Despite the presence of the white settlers they claimed the exercise of their privilege, and began raiding in the old fashion. Matters reached a climax when an impi of Matabele actually penetrated into the camp at Victoria and fell upon and murdered the native servants of the Chartered Company.

Rapidly collecting all available forces, Major Forbes marched against Lobengula, and, after fighting two severe engagements, occupied Bulawayo. Lobengula's territory, or Matabeleland, was thus annexed by the Chartered Company, and the two provinces were merged under the one administration, and given the name of Rhodesia in honour of Mr. Rhodes.

It was obvious that for the safety of the citizens and for the effective occupation and development of the country, railway communication with the south was indispensable, and with feverish haste the extension of the line from Cape Town was proceeded with, until, three years later, the train steamed into the fair city of Bulawayo which had sprung up from the ruins of Lobengula's "scene of slaughter."

From its earliest days Bulawayo advanced with the most extraordinary rapidity. The confidence of the people in the future took the practical shape of numbers of handsome buildings which sprang up from what a few months before had been a Kaffir village. Spacious hotels now welcome the visitor, replete with every modern convenience,

Main Street, Bulawayo.

lighted throughout with electricity, with splendid public rooms, unequalled cuisine, and splendid prices.

It was natural that the people of Rhodesia should wish to show their appreciation of the personality and enterprise of the man whose name had been given to their country, the result being that a magnificent bronze statue of Mr. Rhodes now stands in the Main Street, Bulawayo. The natives for a long time regarded the statue with much awe and many whisperings. The rains fell later than usual, and it transpired that the belief had been widespread that rain could not be expected to fall so long as Mr. Rhodes was left without a hat.

A less ambitious man than Rhodes might have paused and cried halt! enough! But no sooner had the conquest of Matabeleland become assured, than the great project of the Cape to Cairo railway and the trans-continental telegraph began to crystallise in Rhodes's mind. He pictured a great main artery through which British blood might pulse

from north to south, bringing light into the deepest recesses of darkest Africa, dominating the commercial, moral and political situation.

Salisbury was linked up with the coast from the port of Beira, and extension to the north naturally took the way of the coal deposits of Wankie and the Victoria Falls, and pressed on until the line eventually arrived at the Congo border, and was still further extended to the present terminus of Elizabethville, the centre of the huge copper-mining district of Katanga, which is being exploited by the Tanganyika Concessions Company.

The Benguella railway is gradually creeping up to the Katanga plateau, which forms the watershed dividing the Congo from the Zambesi. This line starts from Lobito Bay, a Portuguese harbour, on the west coast. Nearly 250 miles of permanent way are already laid. When this line has been linked up with the main trunk of the Cape to Cairo railway, there will be for the first time a trans-African-continental communication between the west and east coasts, and Rhodesia will lose the monopoly of the heavy down-traffic in copper ore which is now keeping trucks full between Elizabethville and Beira. At the same time the Rhodesian railway system will as a compensation carry the fast mails, passengers, and perishable goods to and from Europe and the Transvaal. The passenger journey from London may then be shortened by several days, and as it may be assumed that the ocean-passage will be more and more accelerated, the Victoria Falls should in all probability in a few years' time come within a fortnight's distance of Great Britain.

The Cape to Cairo line, on account of the development of the Katanga copper, has for the time being been diverted from the route originally proposed by Mr. Rhodes, which was planned to traverse North-eastern Rhodesia and reach the southern limit of Lake Tanganyika, then, passing through German East Africa, to be continued through British East Africa up to the shores of Lake Albert, thence down the Nile Valley. The rails are now to be extended to Bukama, a spot which marks the beginning of the navigable portion of the Congo, here called the Lualaba. With two breaks to avoid cataracts at Congolo and Ponthierville, where the Belgians have already constructed short sections of railway, the journey from Bukama to Stanleyville, about 700 miles, can be performed by steamboats. There remains to be constructed a railway of about 400 miles from Stanleyville to Lake Albert, and then the dream of a connected system of travelling from Cape to Cairo will be an accomplished fact.

The Cape Government made every effort to maintain their hold on the Rhodesian trade, and until recently it was possible to bring certain classes of goods into Rhodesia from Port Elizabeth at the same cost as from Beira, although the distance was four times as great. Beira was boycotted as being Portuguese and unhealthy, and every delay or misfortune that befell the young competitor in its struggle for existence was reported and magnified. But geographical position triumphed in the end, and Beira is now declared the official port for Rhodesia, and about seventy per cent. of the Rhodesian goods traffic passes over the

Beira railway. By the terms of the railway concession the Portuguese simply collect, on behalf of the railway, three per cent. *ad valorem* duty levied on goods in transit to Rhodesia, and therefore no vagaries of export or import duties need be feared. Beira is situated on a narrow spit of sand at the mouth of the river Pungue, and is separated from the mainland by the Chiveve creek, across which a permanent swing bridge has been constructed, which brings the railway lines alongside the Custom House wharves. In the railway reserve a pier is being built at a cost of £100,000, capable of berthing two large steamers, which will be used mainly for the discharge of Rhodesian up-country goods in transit, and for loading home-going vessels with copper and chrome iron ores and for exporting agricultural produce.

The Pungue is the only river with a deep water channel and secure anchorage for large ships between Lorenzo Marques, about five hundred miles to the south, and Mozambique or Pemba Bay, about six hundred miles to the north. Beira, therefore, has the monopoly as the outlet for the entire trade of a vast Hinterland, and may be compared to Hamburg, through which valve the huge commercial oversea traffic of Germany is poured forth. Already a railway of standard gauge connects the port of Beira with the Rhodesian system. This railway was constructed under enormous difficulty, owing first to the unhealthy nature of the coast belt, and secondly to the abrupt rise of 3000 feet up to the Manica plateau: the two barriers that daunted the Portuguese four hundred years before. When the first section was laid, the line was graphically likened to "a huge snake that slithered through fifty miles of dank unfathomable mud," but since then the permanent way has been raised, and traffic is seldom suspended throughout the year. Owing to the heavy mortality of Europeans during the construction of the pioneer narrow-gauge railway the name of Beira throughout South Africa has been vilified as a death-trap. This is entirely incorrect. The low-lying valleys of the Pungue and Busi rivers are better avoided, but for six months in the year the climate of the town of Beira itself leaves little to be desired: a cool sea breeze springs up in the afternoon, and the tides sweep right round the town, up the back water of the Chiveve creek.

Many Europeans have lived in Beira quite healthily for years, and wives of several of the married Portuguese and railway officials have thrived there and brought up families of children. Hotel accommodation has much improved. It is gradually becoming the fashion for Rhodesians to use Beira as a health resort, and to come down to the coast for a breath of sea air, a fish breakfast, and a round of golf, on a course that is second to none throughout the whole of South Africa, and Rhodesian papers now and then record that "the happy pair left for Beira, where they intend to spend their honeymoon."

Besides the existing railway to Salisbury, there is every possibility of a railway being built in the near future from Beira to Chupanga, on the Zambesi, where Mrs. Livingstone lies buried, there to connect with the existing Shire-Highland line, the southern extension to which has been conditionally guaranteed by the British Government. The opinion of prominent officials in British Central Africa is positive that the prosperity

of Blantyre depends on railway connection with a deep water harbour, Chinde being too shallow to be of much service to that growing community. This line will assist greatly in the development of Northern Rhodesia.

It can be well imagined that in the building of two thousand five hundred miles of railway some obstacle would occur demanding the highest engineering skill. The Kafue river on account of its width presented considerable difficulty, and to avoid delay a ferry was constructed, and rails, rolling stock, and engine were ferried across, and the line was worked from both banks. The completed bridge makes a fine picture, and when it is remembered that the Kafue river is over two hundred and fifty miles beyond the Victoria Falls, it is a monument to the optimism of the Chartered Company's directors.

To give some idea of the enormous work of developing a new province like Rhodesia with railways, it is instructive to make a comparison with home distances. The result shows that in twelve years the railways built under the auspices of the Chartered Company would have linked up all the main trade routes in England, Scotland, and Wales, and nobody can fail to see that the all-important transport question in Rhodesia has been unflinchingly tackled and persistently wrestled with. What that means to the settlers in Rhodesia can be gathered from the following facts:—

What used to be a day's journey can now be completed in an hour. The transport of one ton of goods from Beira to Salisbury used to cost £110 and now averages £10, while the return freight from Salisbury to Beira for agricultural products is ¼d. per ton per mile, or 7s. 10d. for the 374 miles. Salisbury and Beira are about as far apart as Glasgow and London: 7s. 3d. spent on the North British Railway will convey a ton of hay, the cheapest class carried, from Glasgow as far as Edinburgh, only 42 miles. Cheap rates to the coast not only fill trucks, which would otherwise return empty, but in offering substantial encouragement to the settler, and thereby fostering enterprise, increase the up-country traffic also.

Prominent among agricultural products that may be expected to swell railway freights from Northern Rhodesia to Beira is cotton. On the banks of the Kafue river cotton-growing is already developing into an industry of some commercial importance. The British Cotton Growing Association, in combination with the Chartered Company, have established a cotton ginnery near the Kafue bridge, and the services of a resident expert are at the disposal of the cotton growers, among whom is numbered His Grace the Duke of Westminster. For four hundred miles the Kafue river is navigable, and for twenty miles on either side are stretches of alluvial soil which here and there is silted over every year, and its fertility renewed by floods which collect on the Katanga watershed and descend in mighty overflow similar to the annual rising of the waters in the Nile valley.

Cotton is one of those tropical products for which the demand of civilised industry is almost insatiable. It is of the highest importance that British colonies should be able to assist in supplying the raw

material to British looms, and if Rhodesia can develop a cotton area, it will be not the least of her services in contributing to the economic prosperity of the United Kingdom and the British Empire.

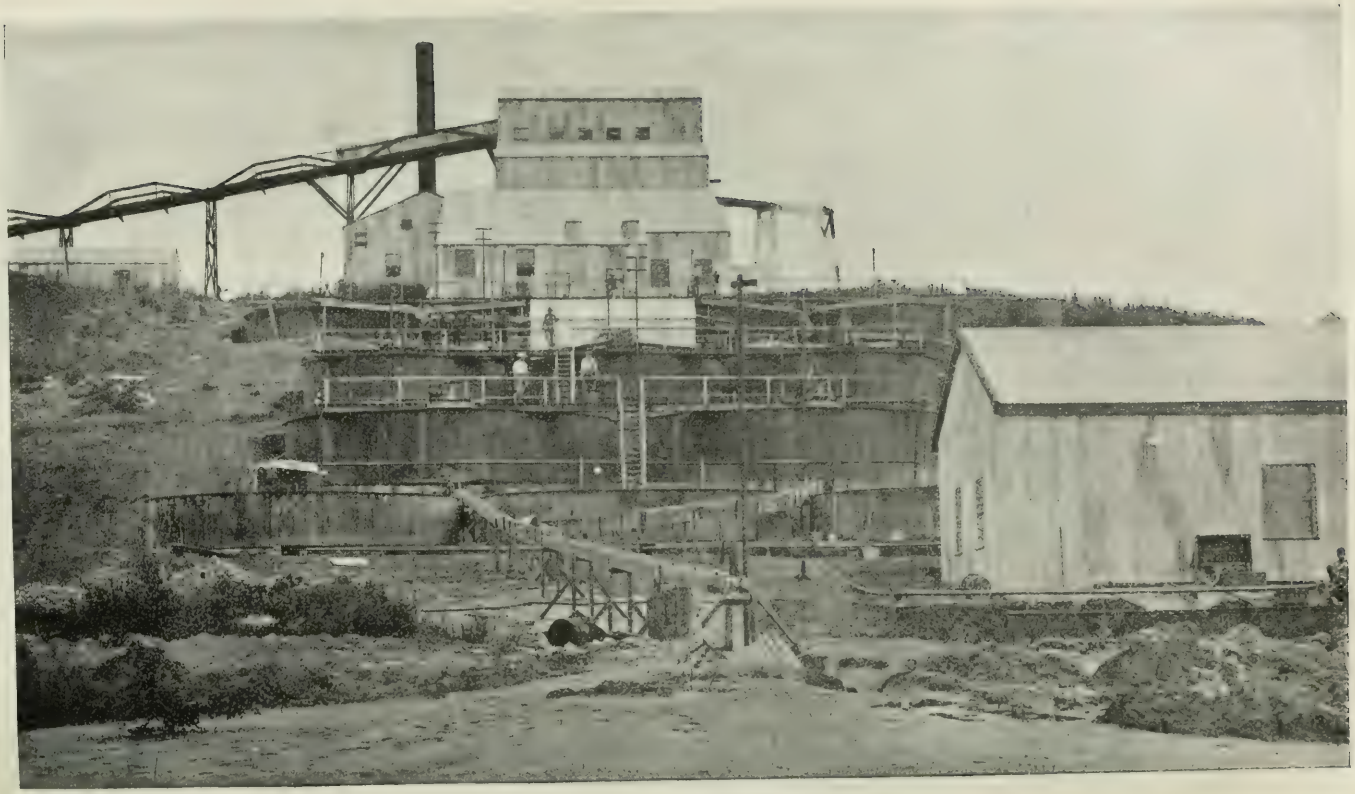
*Mines.*—The magic word gold has ever been the magnet to attract towards new lands the more enterprising men belonging to every nation in the world. It was gold that tempted Cortes and Pizarro. It was gold in California that drew population across the continent of America from the Atlantic to the Pacific ocean. It was gold that started Australia and New Zealand. It was the gold of Johannesburg that transformed the bankrupt Transvaal Republic into one of the richest countries in the world, and it was in a great measure the hope of establishing a second British Johannesburg that spurred on Mr. Rhodes to acquire Rhodesia.

Minerals attract to a country a floating and active population, most members of which go not out to settle but to return whence they came either as wealthy men or as paupers. On the land surface is established not only a settled population, but industries and manufactures, deriving their raw material from husbandry, as well as the professions and trades supported by such a community. The gold industry creates the necessity for agriculture, and settlement on the land follows. To get gold from quartz the entire mass has to be pounded up, washed over amalgamated plates, and the great part is swept away as tailings, while the heavier particles of gold remain behind. Even so with human beings. The rush for the rich strike draws to the roaring mining camp a medley of population, of which the greater number of restless spirits pass away to their destined fate, while the most solid and steady-going remain behind to form the nucleus of a new race, and to get genuine value out of the country of their adoption.

The appearance of the hauling-gear at the pit-head and the huge dumps so familiar in many mining districts in Scotland are becoming equally familiar to the former subjects of Lobengula, and year by year the output of gold is increasing in Rhodesia, largely owing to the efforts of the small miners, tributers who lease claims from the big companies, to whom they pay royalties on profits. The relaxation of the proportion due to the Chartered Company has given an impetus to the industry.

Rhodesia is emphatically a country for the small man as well as for the wealthy capitalist. There comes a stage in mining when, having extracted the ore nearest to the surface, the small man finds that his resources are unable to cope with the deeper levels, and then the capitalist appears and takes over the mine for development. To the Rhodesian output at the present time may be applied the French proverb, *Il faut reculer pour mieux sauter*—one must step backward in order to be able to leap further forward. Many promising mines which yielded good profits to tributers are in the transition stage, having been handed over to large companies who are now engaged in developing reserves and the erection of large batteries. When the preliminaries are completed and crushing recommences the figures of the Rhodesian output will proportionately advance.

A glance at the geological map of Southern Rhodesia shows an octopus-like formation of the gold-bearing schists, whose tapering



The "Giant" Mine, Rhodesia.

irregular feelers grip the plateau at several points, so different from the Johannesburg main reef, where the mines lie blocked together side by side. The influence of this extended spread of mining activity is already affecting the distribution of the population of Southern Rhodesia into small townships, and each mine or group of mines forms a local market for farm produce, which reacts on the value of land over a larger area and tends towards the wider expansion of agricultural interests.

Rhodesia has proved and continues to prove her claim to be mineralised from end to end. Her mineral output includes gold, silver, copper, and zinc ores, lead, coal, and chrome iron. But it is not only the romance of the mines which is attracting population from the Mother Country. There is the even greater romance of the enormous possibilities for agricultural development.

Agricultural products form the basis of a larger trade than gold, and are in the aggregate more profitable. There is more wealth in the soils of Rhodesia than there is in all the mines below the surface.

The most important of the problems which any Government has to face is intensive agriculture, the utilisation of all available land and the conservation of the crop-producing qualities of the soil. Owing to its fertile soil, regular wet season, ample rainfall, genial climate, and cheap land, Rhodesia offers prospects for successful farming operations second to none in South Africa and comparing favourably with most British colonies.

The rainfall averages 28 inches over the whole of Southern Rhodesia. During the wet season, October to April, a wide variety of crops can be grown. Under irrigation a second grain crop, such as wheat or barley, can be raised and harvested during the dry season, which extends from May to September.

*Maize.*—The staple crop of Rhodesia is maize, the South African name for which is mealies. The value of maize as a food lies in the comparatively large percentage of fatty material contained in the grain, and in the starch and nitrogenous substances. The ease with which it is cultivated in newly cleared land is a very important element in the early settlement of a country. When ground its flour forms a cheap and nutritious meal.

Maize is of many colours, white, black, yellow, pink, and red, and in the old Red Indian days, before much skill was shown in seed selection, all of these colours were often found on the same ear, although even at that time the more intelligent tribes showed a preference for grain of a pure white or yellow colour.

The Rhodesian "Salisbury White" variety recently took prizes in open competition with the whole of the Union of South Africa at an agricultural show held in the Transvaal. A thousand tons of Rhodesian maize was bought as a sample by Paisley starch manufacturers and declared to be the best maize that ever came into that city.

There is abundant proof that maize will grow well in Rhodesia and in quality is capable of reaching a very high grade of perfection, but the business men naturally ask the vital question, "Will maize-growing in

Rhodesia pay? When local markets have been supplied will it pay to export the surplus to Europe?"

That Rhodesia will ever be a large maize-exporting country while current American prices hold is doubtful, but the land is quite capable of supplying any local demand, no matter how great.

At times a scarcity of maize has occurred in Rhodesia and prices obtained by the farmers have paid them handsomely, but supposing that in a future season the supply exceeded the local demand, would not expense of transport absorb the farmer's profit or even cause loss?

It is evident that the value of all bulky raw materials must depend on the possibility of cheap transport. Transport after all is a matter of co-operation between governments, steamships and railways, and need not be an insurmountable obstacle to the Rhodesian farmer. Besides, it must be remembered that geographically the Rhodesian farmer holds a strong position with regard to the London market when competing with the farmer in Western Canada or Australia. To convey, for instance, a bag of grain 200 lbs. weight, from the interior of New South Wales, say 400 miles by rail and 12,000 miles by sea, or from a district west of Regina, the heart of the grain-producing province of Saskatchewan, over 2000 miles by rail and 3000 miles by sea (rather cheaper at certain times of the year *via* Fort William and the Great Lakes) costs considerably more than the three shillings which is the present fixed charge for conveying a 200 lbs. bag of maize from any point on the railway in Southern Rhodesia, say 500 miles by rail and 8000 miles by sea, inclusive of grading, broker's expenses, and all other incidental charges. Other export rates for agricultural produce will doubtless, when the time comes, work out in an equally satisfactory manner. It is, however, labour lost to make calculations as to the cost of conveying sacks of maize from Rhodesia to Europe, because farmers will be more likely to make their maize walk to markets in the shape of pigs or cattle.

Preparations are being made for the first bacon factory which is to be erected at Bulawayo, capable of handling five hundred pigs a week. This factory is to be equipped with all the best modern appliances and is intended to be the precursor of similar factories throughout Rhodesia.

It is as a stock food that maize finds its greater use. Not only is the grain used for feeding and fattening cattle, hogs, and fowls, but the whole plant, leaves, and stalks is used for fodder, either dry and stacked, or as "ensilage," kept in large quantities under pressure, or in a pit or "silo."

But it may be asked "How about the locust?" The Rhodesian farmer has discovered a simple and effective method of dealing with the locust and discounting the devastation caused to growing crops. He merely plants his maize a month later than he was wont to do in previous years, the result being that supposing a swarm of locusts arrive on his land the insects, instead of obtaining a good feed off a well-developed plant, which would droop and die after the operation, merely eat off the young shoots just issuing from the ground. The maize renews its vigour as

A modern Farm in the Matoppos.

soon as the locusts have departed, and springs up as it were in derision of the vindictive visitor. The locust in the first stages of its life-history is called by the Dutch "voetganger." It develops wings later on. The easiest time to destroy a swarm, which is done in an ingenious manner, is while it is in the "voetganger" stage. The insects advance in a serried mass. Armed with water pots, containing a solution of arsenic and sugar, the destroyers spray the front ranks, who absorb the poison, and fall a prey to the cannibalistic instincts of their brethren in the second rank, who alike fall victims to the third rank and so on *ad infinitum*. Energetic measures have been taken to deal with this pest. Locust officers have been appointed and an Inter-Colonial Locust Bureau formed. Advices of the movements of locusts are sent from all centres to the bureau, who keep the farmers advised of the whereabouts of swarms. Both farmers and natives co-operate in the work of destruction, and in one season over two thousand swarms were destroyed. Measures are being taken to deal with further invasions of locusts and those hatched in the country during the forthcoming year. A factor in the campaign is the presence of locust birds in large numbers. Steps have been taken to protect these most useful birds by legislation.

*Cattle.*—In the days of Lobengula the principal wealth of the native tribes lay in cattle, which wandered over a thousand hills. Through constant interbreeding the type of native cattle has degenerated into a small but very hardy animal, able to stand exposure and forage for itself. Its rate of increase (80 per cent.) is very rapid owing to early development, and therefore it is valuable as the nucleus of a herd, from which can be developed a larger breed. Agricultural science in Europe has by dint of careful experiments and centuries of thought brought cattle-breeding to a fine art. Cattle are bred for slaughter purposes, milk, or traction. In a new country like Rhodesia it is impossible to expect that for some years a race of cattle will be bred combining all the qualities required. At present the settler requires chiefly oxen for transport and for farm draught.

Horses do not thrive in Rhodesia owing to the horse sickness that is prevalent throughout the sub-continent. Inoculated mules are used on some farms for haymaking and cultivating, but practically all farm work is done by oxen. For this purpose the Africander stock has been largely imported into Rhodesia, this being an animal bred for the yoke, with powerful shoulders, which combines tractability and hardiness with great strength.

Scotland is contributing her famous Aberdeen-Angus towards the future Rhodesian breed of slaughter cattle. The Shorthorn, Hereford, Sussex, Lincoln and Devon breeds all find their admirers. A herd of pure-bred Frieslands, the celebrated Dutch dairy cattle, has been established by some enterprising Scotsman. The dairy industry is capable of great development, according to the report given by Miss Maidmont, the dairy expert, who visited Rhodesia in 1910.

The well-known Argentine firm, the Liebig Company, proprietors of Lemco and Oxo, have obtained the right of selecting areas up to one and a quarter million acres of land for ranching purposes in Southern

Rhodesia, and have already purchased 4000 head of stock, which in itself is a testimony to the excellent pasture of the country. Ranching on a large scale has also begun in Northern Rhodesia, on the banks of the Kafue.

An experiment is being made to domesticate the magnificent eland —the bulkiest of all the large South African antelopes, and the one with the most palatable flesh, carrying, unlike the other antelopes, a fair proportion of fat. Should this prove successful, Rhodesia may produce a breed of her own cattle, immune from disease, and suitable both for slaughter and traction.

However opinions may differ as to the agricultural possibilities of Rhodesia, most men will endorse the words of a celebrated Scottish authority who states that:—

"As a grazing country for cattle during the period of rainfall and luxuriant growth Rhodesia has no equal in South Africa, and it would be difficult to find her superior in any part of the world."

Mention has already been made of the luxuriant growth of grass, which used to be burned down annually. Grass burning is now restricted, and farmers mow large tracts of land for hay, with which to help to feed their animals over the dry season. In Rhodesia haymaking is an easier process than in this country, for it is possible to mow one day, rake the next, and stack the next. An export trade in Rhodesian hay should assume large proportions, when the Transvaal market, at present closed for fear of the spread of disease, is thrown open.

Rhodesia has suffered long from cattle diseases, but the strict, and even stern policy of the veterinary department is a guarantee that an organisation exists which is capable to do battle swiftly with any outbreak. Restrictions concerning the movement of cattle, vexatious and irritating as they may be at the time, serve as an effective protection to the farming industry as a whole. Just recently, from sixty-one specified areas, all restrictions have been withdrawn, and the country is practically free from any cattle plague. In 1901, cattle owned by natives numbered 43,850—ten years later their numbers had increased to 259,000, to which must be added 110,000 owned by Europeans, since, with the exception of a comparatively few imported pedigree animals, all the cattle in Rhodesia are derived from native stock. These figures represent an annual increase of 80 per cent. in herds right through the country.

*Tobacco.*—A conspicuous competitor with cattle-breeding for the attraction of capital to Rhodesia is the growing of high-class tobacco-leaf, a crop which requires intensive cultivation.

As a tobacco-growing country Rhodesia early attracted attention, and is already regarded as a rival to Virginia and Turkey. The Virginian plant is chiefly grown in the neighbourhood of Salisbury, while Bulawayo and district specialise in the Turkish variety. Granite soil, which some years ago was considered worthless, now grows excellent tobacco-leaf. Rhodesian tobaccos obtained a gold medal at the International Tobacco Exhibition held in London, 1908, and since then have borne away honours from several South African open competitions.

The Transvaal Government have paid Rhodesia the compliment of sending a deputation to inquire into the methods employed of fostering and ameliorating the tobacco industry.

Tobacco is cured in various ways,—by sun-curing, air-curing, and flue-curing: the latter method is chiefly being adopted by Rhodesian growers. The flue leads out of the furnace at practically floor-level, runs round the building at a distance of four feet from the wall, and comes out at the same side as the furnace. The furnace is simply a large brick arch, six to eight feet long, so sunk in the ground that the outlet for the flue is but slightly above the floor-level of the building. A flue-curing barn may be used for ordinary air-curing.

The process of curing tobacco somewhat resembles the working of

Rhodesian Tobacco Plantation.

an incubator, in that it requires constant watching and careful noting of temperature and conditions of moisture.

It is refreshing to be able to assert that the locust is considerate enough to avoid the tobacco leaf as an article of diet. This immunity is fortunately also enjoyed by the orange and the lemon tree.

*Oranges.*—Wherever orange-groves exist on a commercial scale, as in California, Florida, and the Mediterranean, the returns are exceedingly profitable—£30, £50, up to £100 per acre per annum, and the world's demand for oranges is inexhaustible. In favour of Rhodesia there are several factors which should make for success, especially cheap labour,

no absolute need for irrigation, and a special season for marketing the fruit. Being in the southern hemisphere, Rhodesia can bring fruit into Europe as early as July, a time when there are no serious rivals. The few small sample shipments that have been tested by London and Glasgow fruit brokers have been pronounced excellent in taste, quality, size, and general condition. There is enough evidence to show that, if scientifically cultivated, Rhodesian oranges and lemons should have a ready sale at profitable prices in the European market.

The cost of planting an acre of orange-trees should not exceed £5 per acre. A wild lemon, probably introduced by the early Portuguese adventurers, grows luxuriantly in the Mazoe Valley, and forms the stock on to which cultivated varieties of both oranges and lemons are budded.

After seven years the estimated average net profit from Rhodesian groves is reckoned at about £50 per acre per annum. The orange-grove bids fair to solve the problem of closer settlement, so much desired in Rhodesia.

Numerous other fruits luxuriate in this land of sunshine. The stately banana serves a double purpose, that of providing a wind screen for other more delicate plantations of fruit-trees being hardly less useful than that of producing fruit itself. Pineapples, peaches, paw-paws, apricots, grapes, and Japanese plums can be grown in any Rhodesian orchard.

The fact that wild ostriches are found in most parts of the country, particularly in the western and midland portions of Mashonaland and in Matabeleland, indicates that ostriches should thrive under domestication. Young birds are obtainable by capture, and special permits are obtainable for this purpose on payment of a fee of £1. Several farmers are at present breeding ostriches in conjunction with other branches of farming.

Woolless sheep are common all over Rhodesia, and it is only comparatively recently that much attention has been devoted to the wool-producing breeds. Now a considerable number of Merinos, Shropshires, and cross-breds are scattered over the short grass districts of Mashonaland and Matabeleland, and small consignments of wool have been sent to the home market. In general the native grass is too rank for wool sheep, and it must first be grazed down by cattle. This is merely history repeating itself, as Australia has gone through the same experience. It is on record that Governor Philip of Melbourne originally condemned Victoria as a sheep country.

*Sport.*—Sport enters largely into the life of the Rhodesian settler. On every farm a shot-gun soon justifies its purchase, as bird life is plentiful and small antelopes still abound. The larger game, followed by the carnivora, are gradually retreating before the rifles of the white man, but swarm in the game reserves, especially upon the rolling plains of Northern Rhodesia. The sport of the wealthy is still the birthright of the Rhodesian of this generation. It would be a sad day if the fiat were to go forth for the wholesale destruction of the magnificent wild mammals, supposing they should be proved to be the cause of keeping alive the tsetse-fly. Science with relentless foot is tracking this noxious

insect to its doom. Modern investigation and experience confirm Livingstone's statement that its habitat is absolutely local. Fly can exist on one bank of a river and on the other bank a herd of cattle can roam in safety. For the farmers, who occupy districts where the fly is non-existent, this pest has no terrors.

Besides small and large game shooting, the Rhodesian can take his choice of all the characteristic British sports. Hunting the jackal—which makes a good substitute for the fox—horse-racing, cricket, and football—all these pastimes enrol their enthusiastic supporters.

Though Rhodesia suffers from the horse-sickness prevalent throughout the whole of South Africa, the saddle-horse and the racer are not uncommon, and horse-breeding is being carried on on a small scale near Plumtree. The animals thrive better in mosquito-proof stables and with individual attention. It is not at all likely that the horse will ever compete with the ox for farm use, although inoculated mules are kept by farmers for riding and for light work.

A brief mention must be made of religion and education in Rhodesia. Churches of various denominations are springing up throughout the province, and spheres of influence have been allotted to missionaries dealing with the native population. The Jesuit fathers at Chishawasha have raised a monument to their spiritual and industrial activity in the shape of a fine church built out of the profits of their farming and teaching operations. Through the munificence of Mr. Alfred Beit, large grants are given to the education of the whites, and children either in town or country come under a comprehensive system organised by a Scotsman, Mr. George Duthie.

We will now pass on to the consideration of other important assets of Rhodesia, including the great natural asset of the Victoria Falls.

One of the greatest assets in Rhodesia is its sunshine. It is rightly called the Land of Sunshine, as fully three hundred sunny days are recorded every year. In one year there was only one day on which the sun did not shine at Salisbury.

Although within the tropics, Southern Rhodesia, on account of its elevation above the level of the sea, enjoys an equable climate and is never uncomfortably hot; there are several weeks during the year when the weather is bracing, and at night the thermometer registers a slight frost. It might surprise some people to be told that the mean maximum temperature of Salisbury throughout the year averages 76° and the mean minimum 53°.

Now that Rhodesia is accumulating a resident population, the primitive pole and dagga hut is fast disappearing. Houses are substantially constructed on a carefully selected site well exposed to the breezes, and away from water or marshy ground. The space round the dwelling-house should be kept clean and free from trees and rank vegetation. The introduction of the mosquito-proof house and mosquito netting for bedrooms, as well as more settled occupations and better conditions of living, have reduced the European death-rate from malaria fever to two per thousand. From the official medical reports it is clear that this rate could be still further reduced if proper care is taken to

avoid the mosquito, which only bites at night. Malarial fever in its mild form is no worse than a mild attack of influenza in this country—but it is only common sense to take simple ordinary precautions to avoid even a mild attack.

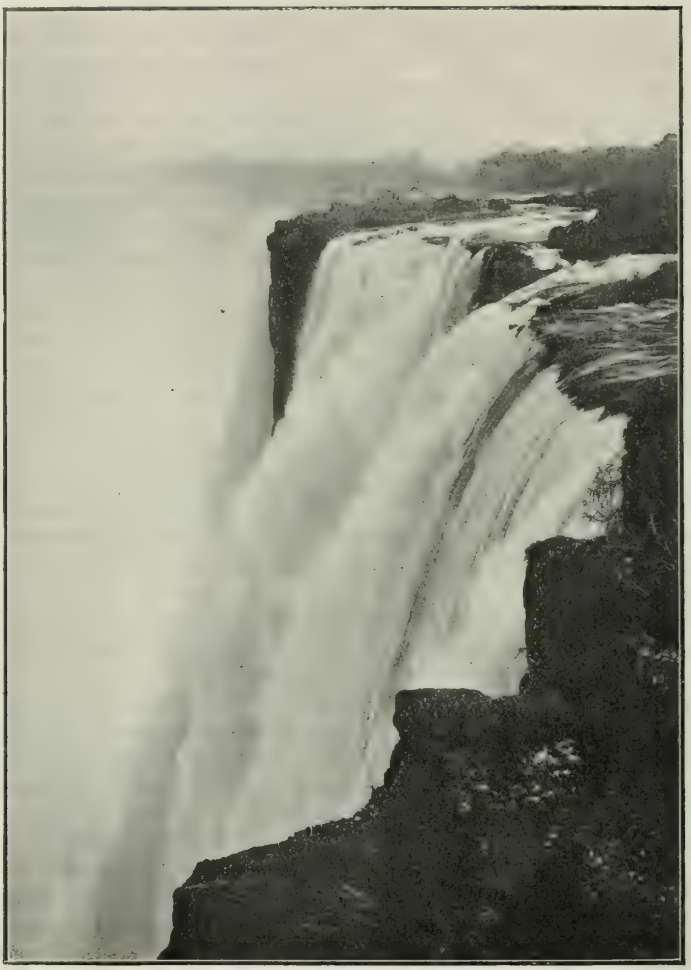
One of the chief assets of Rhodesia is undoubtedly found in the men and women of Rhodesia, the British colonists who are making Rhodesia their home, and are about as fine types of Britons as can be found in the world nowadays. Women's work of making homes in Rhodesia is waiting for the women of this country, and on the type of women that go out to begin that work depends largely the character of its future population. It is a misconception of our British colonies to suppose that all the men and women most suited to colonial life are to be drawn from the lower classes. Rhodesia is not a dumping ground for the unemployed and unemployable. Nor is there scope in Rhodesia under present circumstances for our labouring classes. Men of capital are wanted to create industries. Rhodesia possesses in the native a labour supply of increasing value, and capital is essential for developing the soil and employing the natives on the land.

As great an asset as the men and women are the children of Rhodesia both black and white. The children are the raw material, upon the fashioning of which depends whether they shall add to the common stock of wealth and intelligence and goodness, or whether they shall be cast aside as a waste product on the local rubbish heap. Herein lies the need and the opportunity for British womanhood, of whom we are so jealously proud, who are endowed with the best British traditions, and can be trusted to maintain their high standard of home refinement and true culture.

The black child offers a problem, but one much more capable of solution than the native child of the former generation. He has no traditions of war to disturb his equilibrium, and he is learning the gospel of work and peace. His father has tried both and finds that peace pays best. He is more prosperous and contented than he was in Lobengula's day. The native's wealth in cattle and stock has increased six-fold in the past nine years, and in the same period the native revenue in Rhodesia has grown proportionately larger.

Native labour scarcity in Rhodesia becomes periodically acute for reasons well understood by those on the spot, and need not be considered as a permanent disability to the country. The unprecedented influx of 10,000 whites during the last few years, many of them totally ignorant and careless about the management of natives, most of them engaged in mining or farm development, has caused an unprecedented demand for native labour. The actual number of natives employed throughout the province is larger to-day than it has ever been, and yet the demand remains unsatisfied. The withdrawal of several thousands of Nyassaland labourers materially complicated the situation. It is a satisfaction to know that the Rhodesian native labour ordinances have been adopted *in toto* by the German Colonial Government, having been selected by them as the best pattern of how native labour should be controlled.

The ultimate political fate of this great province is a question of absorbing interest. The increasing importance of Rhodesia to the British empire may be gauged by the significant fact that from January to September in this year her bill for goods purchased in the United



The Victoria Falls from Livingstone Island.

Kingdom amounted to over one million pounds in value. This is mainly due to the Rhodes clause, which gives a preference on British manufactures and secures over 71 per cent. of Rhodesia's trade to the British people at home. At present the unanimous feeling of the Rhodesian settlers is against joining with the Union of South Africa until adequate representation can be guaranteed to Rhodesian interests. The idea has been

suggested that Southern Rhodesia should join the union at the proper time, and that Northern Rhodesia should amalgamate with Nyassaland into a separate colony. The two divisions are diverse in climate and conditions of soil, with different races of negroes, governed under different laws, Northern Rhodesia being administered by British law, and Southern Rhodesia by Roman Dutch law, which is the code in force throughout the Union of South Africa.

Following the main line of railway from Bulawayo to the north, which passes through the huge teak forest on the Gwai river, where millions of feet of valuable timber are waiting the coming of the saw-mill, the train arrives at the Wankie coal mines, which even at this early stage of their development have done great service in supplying the railways with fuel. Their increasing output also is a matter of great importance in providing the line with additional freight. About seventy miles further the traveller is deposited at the Victoria Falls.

To describe in appropriate words this the greatest known elemental force of nature is an impossibility. The natives named it Mosi-oa-tunya, "the smoke that sounds." It is not surprising that in their simplicity they believed that here dwelt the spirits that govern mankind upon this earth, omnipotent, incomprehensible, unapproachable, terrifying. We, "the heirs of all the ages," are inspired by similar feelings, but, with our twentieth-century discrimination, name only the spirits of evil. We speak of the "Devil's Cataract" and the "Boiling Pot," the spray suggestive of the steam bursting forth from some seething witches' cauldron, or fumes from the very mouth of hell itself. When David Livingstone saw this miracle of mysterious, glorious, exquisite beauty, beauty that "makes the mind positively ache with its grandeur," he said, "I was the first white man to see it, but it must have been gazed on by angels in their flight."

Graceful palms and "burly baobab" trees lend a tropical aspect to the scene. In a fissure one can sometimes see a double rainbow gleam brightly on the dense clouds of spray that are thrown aloft to meet the rays of the sun or moon.

The mighty river rolls peacefully onward "from palm-grove on to palm-grove" in its stately course, and without warning takes one headlong plunge in cataract, leaping in glittering glory to its fate, "shattering on black blocks a breadth of thunder."

The scene might be compared, without any over-fanciful stretch of imagination, to a regiment of cavalry in the olden days of warfare doomed to the supreme horror of a cruel ambuscade. One can picture a superb body of mounted men, riding by, a pageant of colour, all unconscious, all unsuspecting of the presence of a hidden foe, the troopers swinging easily in their saddles, the brilliant sunshine dancing on their polished helmets and accoutrements, gay jest and laughter rippling from rank to rank.

Suddenly on every side the brushwood springs into life with armed men, a thousand swords flash from their scabbards and deal bloody death around—confusion reigns—ranks are broken and thrown into disorder —annihilation seems to be inevitable.

No! Hark! a rallying bugle sounds—a breach through the walls of the encircling enemy has been hewn by the sword, a way to escape lies open for brave hearts. With a mighty cheer the horsemen sweep through the narrow gap. Free! Free!

The Cape to Cairo railway passes through the Rain Forest, in deference to Mr. Rhodes's expressed wish that "the spray should come over the carriages," and crosses the gorge by a bridge of a single span built on the cantilever principle, similar to the Forth Bridge. The train crosses at a height of 400 feet above the water level of the Zambesi, that is, fully twice as high as the Sir Walter Scott memorial in Princes Street, Edinburgh. Conceive a huge mass of water tumbling over the edge of a great cliff stretching from the Caledonian Station to Burns's Monument, into a chasm no wider than Princes Street itself, then you may have some notion of the vastness of these falls, without the tropical setting, without the brilliant sunshine or moonshine streaming through the columns of spray, without the rainbows, without the deafening thunder of the waters hurled into the abyss below.

Geologists have determined that these great gorges have been hollowed out in countless ages by a process of erosion. They can trace a deepening channel now in process of formation diagonally across the river, which in ages to come will form another huge arm to add to the existing forty miles of zigzag canyons.

The Chartered Company have wisely decreed that no installation of electric power stations shall in any way interfere with the supreme beauty of these stupendous falls, but sooner or later the force now running to waste—estimated at about thirty-five million horse-power, or about five times the power of Niagara—will be brought under control. Practically five hundred thousand people are employed in the immediate neighbourhood of Niagara Falls on works that are totally dependent on the application of electricity generated by water-power. With the increase which engineers anticipate in the distance of transmission the Victoria Falls should be able not only to support a large manufacturing population near at hand, but also, it has been thought, even to supply electrical power to the mines at Johannesburg, about 600 miles away.

Sir William Ramsay, at a meeting of the British Association, stated that in six generations our coal would be exhausted and our home manufactures perhaps brought to a standstill. It may be that by that time a population of British workmen will have sprung up round the Victoria Falls and Rhodesian cotton will be spun into cloth not in Lancashire but on the banks of the Zambesi. Then, more than ever before, our nation will have reason to admire the foresight of Mr. Rhodes and to recognise what it owes to his indomitable pertinacity.

At his appointed hour the great Imperial athlete finished his course and handed on the torch to his successors in the race. Rhodes elected to be buried on the summit of a lonely granite hill amid the wild grotesque scenery of the Matopo Mountains. "Energy come to rest with the blue vault of heaven above and the massive granite beneath, emblems of his lofty inspirations and his solid work."

Hundreds of white men from every part of South Africa collected at

that weird spot, while thousands of affrighted natives huddled in groups upon the surrounding kopjes, awestruck by the solemnity of that dread burial ceremonial. It may be said of Rhodes that the good that he has done lives after him. By writing his name large upon the map of the world his fellow-men during his lifetime have paid their greatest tribute to his genius and have given him the highest honour in their power to bestow, an honour only shared, after their deaths, by the discoverers of new worlds, Columbus, and the two comparatively obscure personages, Amerigo and Tasman.

Rhodes is gone—

> "Who seemed so great.
> Gone! but nothing can bereave him
> Of the force he made his own being here."

And that force, the motive power of his whole life's work, was his implicit belief in the character of the British people. Rhodes stands forward as the exponent of sane Imperialism. He believed that to the British people, more by accident perhaps than design, has been entrusted a mission to assume the supreme direction of a world-wide Empire, throughout which to introduce and maintain the twin indissoluble principles of liberty and justice. Rhodes has flung with all his force a stone of British blood into the centre of the dark pool of Central Africa. It is not for us here in Scotland to sit down and carelessly watch those widening circles. Our duty it is, nay, our profit did we only know it, to accept and take an active part in the development of this great legacy to the British race.

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## SARAWAK.[1]

By Sir Percy Cunynghame, Bart.

(*With Illustrations.*[2])

As I propose to take my readers a journey of nearly 9000 miles and to land them on the shores of a country which, beautiful and attractive as it is in many ways, is still comparatively unknown and quite out of the beaten track of tourists and travellers, it will perhaps be as well if I begin by giving some general description of the great island, of which Sarawak itself forms only a part, though perhaps the part about which least is generally known.

The island of Borneo is 850 miles in length, 600 in breadth, and contains an area of 286,000 square miles. It is by far the largest island in the world if we except the continent of Australia and the island of New Guinea. It is very mountainous, especially towards the north, where

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[1] An address delivered to the Society in Edinburgh on Feb. 6, 1912.

[2] The illustrations accompanying this paper are from photographs taken by Dr. C. Hose.

the mountains approach the sea so closely that the rivers are unimportant in comparison with those in other parts of the island.

Borneo is divided by the equator, Pontianak, the capital of Dutch Borneo, being situated upon it. The largest portion of the island lies, however, to the north of the line.

The chain of islands formed by Sumatra, Java, and the connecting links to Timor, represent a line of weakness in the crust of the earth, and these islands are still subject to volcanic action. In Borneo, however, there are no active volcanoes, nor, so far as I know, any extinct ones. In Sarawak hot springs are found, the waters of which are impregnated with sulphuretted hydrogen. The island is stated by authorities to owe its origin to a vast upheaval of plutonic rock, which has forced its way through the overlying beds; but the granite does not come everywhere to the surface.

Borneo is probably the best watered island in the world; there are numerous rivers originating in the mountainous interior. The rainfall over the whole island is very heavy, the wet months being from October to April. It is this heavy rainfall, in combination with the fierce sun, that causes the extraordinary vegetation which is so marked a characteristic of the country.

Mr. C. A. Bampfylde, formerly Resident of Sarawak, has given the following short geological description of the country: "The hills and ranges of upland consist of blue metamorphic limestone on which is superposed a thick series of sandstones, conglomerates and clay shales. Piercing these beds are granite and a variety of plutonic rocks, as diorite, porphyrite, etc. These latter are developed in greatest abundance in the antimony districts, where they are in immediate contact with the limestone that has been fissured and tortured by upheaval. The sandstone shales have also been tilted and distorted; nevertheless in places they retain their original horizontal position. They are usually found to be impregnated with peroxide of iron. It is in this formation that the cinnabar deposits occur.

"Both limestone and sandstone have been extensively denuded, and the latter rises in isolated tabular mountains, or short peaky trends, to an altitude occasionally of 1500 feet above the sea, the ridges being separated by undulating valleys in which the limestone comes to the surface. Sometimes these denuded masses form low hilly tracts, varying in elevation from 200 to 1200 feet; sometimes they appear as solitary crags, but invariably they present long lines of ancient seacliff, and bold scarped faces, fissured and jointed in every conceivable direction.

"In the intervening lowlands is a deposit of dark yellow felspathic clay, varying in depth from a few feet to eighty feet or more, derived from the degradation of the hills by water. Associated with this clay and of more recent date are superficial deposits of pudding stone and gravels. The intrusive igneous rock shows mainly in the form of dykes, seaming the stratified rocks; consequently volcanic action took place subsequent to their deposition, but it was also antecedent to the more recent of the superficial deposits. It is in immediate connection with those plutonic dykes that we find the deposits of arsenic and cinnabar, occupying the

fissures produced in the stratified rocks by volcanic upheavals, and we are led to the conclusion that these mineral lodes were deposited after the cessation of the upheaval.

"Gold occurs in the form of fine sand in the alluvial deposits, and in the gravel of the rivers over a great part of Sarawak : and also in pockets of the limestone into which it has been allowed to fall by water. Nuggets are of extremely rare occurrence, but Sir Spencer St. John mentions having seen one of seven ounces taken from the auriferous clay at Krian near Bau. The gold dust is usually in a state of finest comminution. So far no gold reef has been come upon." (*A History of Sarawak*, by Baring-Gould and Bampfylde.)

English and Dutch traders appeared in Borneo early in the seventeenth century, and were also heard of again in the eighteenth century, but it was not until the nineteenth century that any permanent colonies were established. The country was originally under the government, or perhaps it is more correct to say, under the nominal government, of various Malay sultans, of which the sultanate of Brunei was of the greatest importance. Brunei still exists, though its glories have long since vanished. It has now been taken over by the British Government, which directs its affairs through the medium of a Resident : it is hoped, therefore, that the place may once more become of some importance.

Brunei has been compared by an enthusiastic traveller to Venice, a comparison which is, however, very unfair. The houses are, it is true, built over the water, and it is only possible to get about the town by means of boats. It is no exaggeration to say that a Brunei baby can swim almost as soon as it can crawl. One of the strangest sights of Brunei is its floating market, which consists of an enormous collection of canoes in which sit women, who wear on their heads huge hats the size of an umbrella, which, being for the most part white, resemble a collection of gigantic mushrooms.

Brunei, though no doubt interesting and picturesque, is, however, too squalid and dirty to deserve more than a flying visit.

About 25 miles from Brunei in a north-westerly direction, lies the island of Labuan, one of the smallest colonies we possess. It has only a total area of $30\frac{3}{4}$ square miles. It is now administered as a crown colony in connection with a portion of the Brunei coast, and has therefore become of some importance. A few years ago, however, the total number of government officials numbered three, each one holding several appointments in his own person, for it must be remembered that the island was a crown colony and had to be administered with all the red tape considered necessary to the proper working of such : but when I add that the governor was an ex-naval officer and that the tiny colony was as well managed as a British man-o'-war, you will understand that it would be impossible to accord its administration higher praise.

Labuan is a sort of half-way house between Singapore and British North Borneo, and immediately after leaving it we begin to skirt a coast which is surely amongst the most beautiful in the world. Here the mountains in many places seem to almost over-hang the sea, though

they are really in many cases far further inland than they appear to be. The most noticeable one is the magnificent mountain of Kina Balu, which being translated means the "Chinese Widow," a reminiscence, no doubt, of the time when Borneo was a Chinese colony, of which indeed we come across many reminders. Kina Balu is 13,700 feet high, and on a clear morning its noble outline can be clearly defined, forest-clad nearly to the summit, interlaced with bands of silver, showing the many crystal streams which flow from it.

North Borneo can boast some fine harbours, for the water is in many places deep close in to the shore. Rich in many ways, it is without doubt a country with a great future before it.

After passing round the north part of the island, we eventually arrive at Cowie Harbour, the limit of British North Borneo territory, and we now come to that part which is under the Dutch, either directly or through native sultans who acknowledge Holland as the sovereign power. In Dutch Borneo we have a different country for the most part, the coast being shallow and the size of the rivers enormous. The capital, Pontianak, is situated on the mighty Kapuas river, whose head-waters touch Sarawak territory.

The nearest place of importance to Borneo is Singapore, to which most of its trade goes. We have also to the north the Sulu Islands, formerly under Spanish rule, and now under that of the United States. Further on still are the Philippines, whilst on the east are Celebes and New Guinea, and to the south and south-east are Java and Sumatra.

Having now given you some idea of Borneo as a whole, I will return to that part of it which I know best, with which I am dealing more especially in this article.

The first part of Sarawak we come to is Cape Datu; here the hills attain a height of 2000 to 5000 feet, until we pass the mouth of the Sarawak river, 25 miles up which lies the capital Kuching. After leaving the Sarawak river we begin to lose the hills, which here recede inland, and we come to a long stretch of coast which is flat and uninteresting until we reach the northern part of the territory, where the hills again begin to rise.

The principal rivers of Sarawak are, the Rejang, Batang Lupar, Saribas, Sadong, Bintulu, Baram, and Limbang, all of which are used as waterways, and indeed form the only means of access to the interior. Some of the rivers, especially the Baram and Bintulu, have troublesome bars, and in fact the whole of the Sarawak coast is practically open to the full fury of the north-east monsoon, which lasts from October to April, and renders some of the rivers impossible of access during these months. The Batang Lupar and Sadong rivers have also, owing to the configuration of the coast, dangerous bores, which add to the difficulties of navigation.

The mouths of the rivers are exceedingly wide, and many of them find their way to the sea through several outlets; the Rejang, for instance, has no less than five distinct mouths, between the extremes of which is found an area of 1200 miles of unbroken swamp.

The Rejang is the largest river of which Sarawak can boast. It is

navigable for good-sized steamers for 170 miles, and if boats are then brought into use, and the great rapids safely negotiated, it can be used for a further 650 miles, as it again becomes sluggish and deep in parts.

The climate of Sarawak is hot and humid and particularly moist during the north-east monsoon; the rainiest months are December, January, and February; July being perhaps the driest. The average yearly rainfall is 160 inches, the maximum recorded in any one year being 225·95. The heaviest rainfall for one month was 69·25 inches, and in one day 15·3 inches. Rain falls on an average 226 days in the year. It is no doubt for this reason, and also because of the land breezes

Fig. 1.—Head of the Great Rapid on the Rejang River.

which blow down from the mountainous interior, that the heat is not very oppressive; the mornings, evenings and nights are generally cool. In 1906 the maximum average temperature was 91·6°, and the minimum 71·2°; the highest reading was 94° in May, and the lowest 69·6° in July.

The country is divided for the purposes of administration into four residencies, which are again sub-divided into smaller districts. The first division consists of what is known as Sarawak proper, and extends from Cape Datu to the Sadong river, which it also includes. The second division embraces the Batang Lupar, Saribas, and Kalaka, the third the Rejang, Muka, Oya, and Binutulu rivers, whilst the fourth takes in the Baram, Limbang, Trusan, and Lawas districts. Most of these districts have large forts or block-houses scattered through them, which are the government headquarters, and are sufficiently large to provide room for the native police garrison, government offices, as well as officers' quarters. In these forts guns are mounted, and they are sufficiently strong to withstand any native attacks, but they are now being superseded gradually by bungalows and police barracks, as the need for the protection which the forts used to afford has now passed away.

Nearly all the important stations have government steam launches attached to them on which the officers spend a good deal of their time, for the districts are so large that it is only by being constantly on the move that they can be properly supervised. When launches cannot be used, boats are requisitioned, and are sufficiently large to be used with comfort. This travelling about is by no means the least pleasant part of an out-station officer's duty, and his lot is often envied by those tied down by departmental work to headquarters.

The history of Sarawak, as far as we are concerned, may be said to have begun with the advent of Sir James Brooke, then Mr. Brooke, in the year 1839. Mr. Brooke was then a retired officer of the old East India Company, and, being interested in geographical discovery, he visited Borneo in his yacht, the *Royalist*. He was then thirty-six years of age, possessed of an independent fortune and of a personality which may perhaps be compared to that of the late General Gordon. On his arrival in Sarawak he found the country in a state of rebellion against its Malay ruler, Pangeran Muda Hassim, who was connected with the royal family of Brunei, of which Sarawak was then a province. Brooke threw in his lot with the rajah, and owing to his efforts peace was restored. So much had Mr. Brooke impressed the Malay ruler that he offered him the governorship of the country, which he accepted, and his appointment was later confirmed by the sultan of Brunei.

I may say here that the territory thus ceded to Mr. Brooke was comparatively small, and that it has since been enlarged from time to time, not by conquest or force of arms, but by the full and free consent of the Brunei sultans, and always with the approval of the people of the districts which thus came under Sarawak rule. Finally the independence of Sarawak under Rajah Brooke, as he was then called, was recognised by the British Government in 1863.

Such are the bare outlines of the commencement of the Brooke rule in Sarawak. But to any one who takes the trouble to think about the matter at all it is evident that the history of Sarawak forms one of the most romantic stories which has ever been connected with the white man's government of eastern races.

Here we have an adventurous young Englishman, who, in spite of difficulties and dangers which must have been appalling, establishes himself as the absolute ruler of a country, and by his commanding personality wins not only the consent of the natives to this state of things but also obtains their active support. One can picture to oneself the constant struggles endured in that enervating climate, the depression caused by failures, sometimes so great as to have nearly overwhelmed the man, condemned by his own choice to a lonely life of exile, to an existence devoted solely to the interests of his jungle people. But in spite of all he remained at the post of duty, and, bearing all this in mind, one can hardly wonder that in the end these same subjects of his repaid him with a love and devotion which has, I think, rarely been equalled in the history of the world.

Sir James Brooke reigned for twenty-six years (1842-1868), and was then succeeded by his nephew, Sir Charles Johnson Brooke, the present

rajah, who has closely followed the policy laid down by Sir James Brooke in all cases where the natives are concerned. The government of the country has, however, naturally developed in conformity with its altered conditions, and it has now all the ordinary departments of a crown colony. Its capital, Kuching, is a clean and busy little town, with a fine water supply taken from a mountain 10 miles away, an up-to-date hospital, under English doctors, a museum under the direction of a distinguished naturalist, good roads running in all directions, a telephone service, and in fact all the essentials of an ordinary civilised country. I should like to lay stress on this because, later on, when I am describing scenes in the far interior, it may give my readers the impression that I am dealing with an entirely wild and barbarous country, and if this should be so, I would ask them to remember that the interior of Borneo is still very inaccessible, and that the wild tribes who dwell in the hinterland are still in a very primitive state, and being for the most part warlike, still occasionally indulge in head-hunting expeditions against tribes with whom they have, in many cases, feuds of long standing. It is, however, worthy of notice that these outbreaks are never in the first place directed against the government itself, and it is only when natives living under its protection are attacked that punitive expeditions are despatched in the interests of law and order. Civilisation is spreading from year to year, but from the nature of the country it must be some time yet before it is entirely settled.

The Malays are perhaps the first Sarawak natives who should be mentioned, as they, with the exception of the Chinese, are the most civilised and law-abiding part of its population. Strictly speaking, however, the Malays are not natives of Borneo, having emigrated to it from other countries. Probably their original home was Sumatra, and their origin is attributed by some authorities to people from Southern India, who emigrated from that country to Sumatra, and in time became mixed with the people already inhabiting that island. Their connection with Borneo has, however, been one of centuries, and they have always been the ruling class there. In Sarawak they are found for the most part near the coast, for the Malay is essentially a man of the sea, and is never really happy when far from it.

I am afraid the generally accepted idea of the Malay, amongst those who have never met him, is that he is of a cruel and treacherous disposition; personally I have never found him so, but on the contrary a very lovable person, no doubt with many faults, but responding readily to kindness, and capable of showing the greatest devotion to a European of whom he is fond. As an instance of this we may refer to the part which the Sarawak Malays played in the year 1857, the date of the Chinese insurrection.

The Chinese gold miners in Sarawak, urged thereto by the intrigues of a secret society in Canton, rose in rebellion and attacked Kuching. The capital was at that time weakly garrisoned, for it must be borne in mind that the settlement of the country was still in the making, and that Sir James Brooke had still to struggle against tremendous odds. His own personal safety and the stability of his government rested

solely on the loyalty and devotion of his native subjects, and the hour of trial was now at hand.

The Chinese rebels found the capture of Kuching an easy task, and meeting with but little opposition sacked and burnt the greater part of the town, killing several of the Europeans. The rajah's house was surrounded, but he himself, although lying ill with fever at the time, managed to escape by swimming across a creek, on the bank of which he lay for some time unconscious. Finally, however, he managed to make his way to the house of one of the Malay chiefs. Now here we see the rajah or governor, a fugitive, without power or authority of any kind. He throws himself upon the protection of men of an alien race and creed who had only to hand him over to the victorious Chinese to secure large rewards and immunity for themselves. There was, moreover, no question of the Malays themselves being seriously threatened, the movement of the Chinese being directed solely against the European government of the country.

To their credit be it said, the Malays responded most nobly to this test of their loyalty. They gathered round their white rajah and protected him as they would have one of their most cherished possessions, until such time as his other faithful subjects could collect and form an army which drove the Chinese out of the country, giving them reason to curse the day when they had taken up arms against the Government. Such was the conduct of the Sarawak Malays during this crisis in the history of their country.

Malays are all Mahometans in religion, though they are not at all bigoted. As soon as a Malay has made sufficient money he performs the pilgrimage to Mecca, though whether he returns to his own country a better or a worse individual is perhaps open to question. From his own point of view, however, he is a distinct gainer, as he has acquired an odour of sanctity which remains with him for the rest of his life.

The Malay is seen at his best on the water, and in Sarawak the annual regatta was always a big affair, attended by Malays from all parts of the country, who in many cases brought their womenkind with them.

In build the Malay is rather less than medium height, with somewhat broad features, straight black hair, and big dark eyes. His complexion is light brown, some of the women being very light coloured indeed. The Malay woman is generally pleasant-faced without being beautiful; her teeth are white and beautiful unless stained with betel nut, a custom which is fortunately dying out.

To sum up, the Malay is a person of charming manners, always polite and generally good-natured; he is averse to the drudgery entailed by any form of manual labour, and is therefore, rightly enough, considered lazy, yet if he has the chance of doing any work which interests him, especially if it has a spice of danger in it, he at once contradicts his reputation by displaying tremendous energy. All the steamers in the Sarawak Government fleet are manned entirely by Malays, who make excellent engineers as well as sailors. The laziness of the Malay is no doubt due to the influence of the bountiful country in which his lot is cast,

where there is no real poverty and therefore no great incentive to work He hates to be worried himself, and so is not given to worrying others. Although others have described Malays very differently, personally I shall always remember Sarawak Malays as good fellows and pleasant companions, trustworthy, brave, and devoted.

With regard to the many other races which inhabit Sarawak, it is impossible in this article to give more than a short account of those of the greatest importance at the present time. It would be difficult to give anything like a full description of the many tribes and sub-tribes which form part of its heterogeneous population. It is probable that Borneo may have had earlier inhabitants than those which we now find there. Stone implements have been found which seem to support this theory. The most uncivilised tribes, namely the Ukits, Bukitans, and Punans, which are fast disappearing, were the earliest inhabitants of whom we have any knowledge. Their origin we cannot trace, but they are undoubtedly related in manners and customs.

The jungle people called Ukits are light in colour, probably because they are seldom in the open, and are fairly good-looking. Some of them are now becoming civilised, but no doubt a great number of them still roam about in the jungle, subsisting on its many vegetable products and on the wild animals they kill. These jungle people are experts with the blow-pipe, and poison their darts with the juice obtained from the upas-tree. The blow-pipes are bored with almost as great care and accuracy as is used in the manufacture of a modern breechloader, and within limited distance can be used with deadly accuracy. The Dyaks say that good as they themselves are in the jungle, the Punans and Ukits are better, and that members of their tribe often get killed without ever having seen the enemy. It is of course quite possible for a man to be wounded by a poisoned dart without ever realising the nature of his hurt, in a jungle so full of prickly thorns that he is constantly receiving cuts and scratches of all kinds. Nevertheless, if the poison is sufficiently fresh, he is a dead man, in all probability. These Ukits are so shy and so afraid of coming in contact with strangers that the Malays who traded with them in the old days used to adopt the following method of disposing of their goods. On arrival at what was considered a likely spot a gong was beaten, and the various articles of trade which had been brought hung up in trees. The traders would then drop down river for some distance. Next morning they would return, and if they had hit on the proper place would find their goods removed and jungle products, such as camphor or rubber, put in their place, so that the deal was accomplished without the parties ever having seen one another.

The Ukits differ from most of the other inland tribes of Borneo in not taking heads, and the Punans do not tattoo themselves. The Ukits and their kindred tribe, the Bukitans, are to be found in the upper waters of the Rejang, Balleh, and Kapuas, and the Punans in those of the Baram and Baloi.

The Kayans and Kenyahs are still important tribes living in the Baram and the headwaters of the Rejang. They are also found on the Dutch side, in the Batang Kayan, Koti, and Kapuas. They are tattooed,

as are most of the interior people. The extraordinary custom of elongating the ears exists amongst these people. It is done when the children are young, and the lobes of the ears become so distended that they frequently hang below the shoulders. In some cases the lobes are so elongated that the head can be passed through them.

Fig. 2.—MacDougall Falls, 380 miles up the Baram River.

In some ways these people are perhaps more civilised than the Sea Dyaks, building better houses, maintaining more discipline amongst themselves, and being exceedingly clever in the manufacture of arms, formerly extracting their own iron from the native ore for that purpose. In character, however, they have still the reputation of being vindictive and cruel, and in former days, when a new house was being built, it was the custom to propitiate the earth spirit by passing the main posts through the bodies of slaves. Human sacrifices are now a thing of the past, but there is no doubt that if the fear of the Government were removed that they would again revive.

The Tanjongs, Kanowits, and Kajamans are probably of the same stock as the Kayans, whilst the Sebobs and Madangs are sub-tribes of the Kenyahs.

The Milano are a large and important tribe inhabiting the coast of Sarawak. They are undoubtedly akin to the Kayans, although they are a settled orderly people, very like the Malays, with whom indeed they are a good deal intermixed, many of them having become Mahometans. Their differences from the original stock from which they sprang can be easily accounted for by the fact of their having remained on the coast, and so being in constant touch with civilisation, whilst the Kayans remained in the interior. The Milanoes cultivate sago, and the enormous size of these sago forests needs to be seen to be realised. I may say here that Sarawak provides a great part of the sago supply of the world.

The Kadayans, Muruts, and Bisayahs are also tribes inhabiting Sarawak. The former are a peaceful and agricultural race and, like the Malays, are Mahometans in religion. The Muruts and Bisayahs inhabit the Limbang, Trusan, and Lawas districts and are of Indonesian stock. In the lower parts of the rivers in question these tribes are engaged in

the cultivation of sago, and they also keep large herds of buffalo ; in the interior, however, the Muruts are still very wild and uncivilised, and though of too cowardly a nature to give much trouble to Government, they are occasionally guilty of head-hunting raids.

Of the Dyaks there are two distinct races, the Land Dyak and the Sea Dyak. The former are so called because they are unaccustomed to the use of boats and appear to be of Hindu origin. They differ very greatly from the other tribes, and have many admirable qualities, but are a decreasing race, and were it not for the protection which the Government affords them, would long since have gone under. They are to be found in the Samarahan, Sadong, Sarawak, and Lundu rivers. The Sea Dyaks, on the other hand, are a strong and increasing people, whose tendency is to overcome the tribes with whom they come in contact and continually to occupy new districts. They are called Sea Dyaks, not because they live near the sea, but because in the old days they were the people who accompanied the Malay pirates on their sea expeditions, receiving as their share of the plunder the heads of the victims, and, very often, little else. This head-hunting propensity has earned for the Sea Dyak a bad name, and there is no doubt that it is a custom to which they are much addicted, and which only the fear of punishment from the Government prevents them from indulging in still. They look upon a head as a trophy, and in former days many a Dyak girl would refuse to marry a man until he had proved his valour by taking a head, it did not much matter whose. Occasionally even at the present time they break out, and a report will come in that a party of young braves has gone on the warpath and has attacked another tribe, the result being always given in heads. In justice to the Dyaks, it must be said that these attacks are generally made on people with whom they have hereditary feuds, but occasionally quite harmless aborigines are the victims, or even in rare cases the ubiquitous Chinaman. The Dyaks are unfortunately averse to any settled occupation ; they do most of the jungle work in the way of collecting wild rubber, camphor, and other jungle products. They have, however, taken kindly to soldiering, and the Sarawak native regiment contains some fine specimens of this interesting race. The Dyaks undoubtedly come from the same

Fig. 3.—Sea Dyak.

stock as the Malays, and in appearance are very like them, especially to any one having only a superficial knowledge of both. Though short, the men are generally beautifully made, broad at the shoulders and slim at the waist, legs and arms being magnificently developed.

The Dyak woman deserves a notice to herself; she is generally passably good-looking, strong and active. At home, besides the work of the house, she does a large share of the rice planting, and is also clever at mat-making and in the manufacture of native cloth. Her full dress is a curious one, as, in addition to a short petticoat, the upper part of her body is covered with a sort of corset of brass rings laid one on top of the other. The corset is very heavy, and if a Dyak woman has the misfortune to be upset from a boat when dressed in this way she is almost certain to be drowned, as she will sink like a stone. Apart from their head-hunting propensities, the Dyaks are a kindly and hospitable people, and are always liked by all Europeans who come into contact with them. They are honest, thrifty, comparatively moral, and possessed of great energy and independence. They are at the present time increasing largely in numbers owing to intertribal warfare having been checked by the Government.

Fig. 4.—A Dyak Woman.

It would hardly be right in this brief description of the races which inhabit Sarawak to omit the Chinaman, who is indeed to be found everywhere in the country, including even the far interior. Only a part of the Chinese in Sarawak are country-born, but without these industrious people the State of Sarawak would indeed be a poor country. They form the mercantile, trading and artisan classes and also are the principal agriculturalists and the only miners of any worth. A Chinese merchant of any standing is as honest as a European in his dealings, and his word is as good as his bond. They are, especially when well off, charitable and liberal, fond of improvements, and thoroughly fitted in every way to assist in the government of the country in which they live.

The Europeans in Sarawak are comparatively few in number, and consist principally of those in the Government service, planters, miners, and merchants, also members of the two missions, the S.P.G. and the Roman Catholic, who are scattered all over the country. There is also a small population of Eurasians, most of whom are clerks, and a considerable number of natives of India, who generally manage to make a good

living in Sarawak. Tamil coolies are imported for estate work in considerable numbers, and of late a few Japanese have begun to take up land and to settle in the country.

Agriculture is the chief industry of Sarawak, sago and pepper being the most important articles of export.

The sago palm is indigenous to the island, and several wild varieties may be met with in the jungle. The cultivated palm grows in the low swamp country along the coast, and is principally worked by the Milano population. To the north there is also a rich river, the Limbang. The sago grows in veritable forests which stretch mile upon mile from the mouths of the rivers.

From time immemorial pepper has been cultivated in Borneo. Its introduction has been attributed to the Chinese, but as pepper is not a product of China it is perhaps more probable that it was introduced by the Hindus. In any case it is now almost entirely in the hands of Chinese planters. In appearance a pepper plantation is not unlike a hop garden. In 1907 Sarawak exported 5177 tons of pepper, and it is at the present time a great and flourishing industry. Borneo is essentially a rubber-producing country, and extensive plantations are now being laid out. In the future it will no doubt pay well, more especially if the natives take to it kindly on their own account. Agriculture in Sarawak, with the exception of sago and pepper, will however be dependent on imported labour for some time to come. The Malays and Dyaks are too well off, and persistent and hard work is too foreign to their nature to enable planters to count upon them as reliable coolies. It is a very significant fact that in a country like Sarawak, so suitable in every way for the cultivation of rice, a very large amount has to be imported every year to feed its population. Even those natives who do undertake rice-planting do not as a rule cultivate more than is necessary for their own requirements.

Jungle produce still figures largely in the list of exports, though no doubt as time goes on they will decrease. The principal products are gutta, indiarubber, cutch, rattans, timber, birds' nests and beeswax. The birds' nests mentioned are those which are considered so great a delicacy by the Chinese when made into soup. Personally speaking, I have tried it and failed to appreciate it. The nests are those of a swallow which builds in large caves. Some of these caves are of great size and are valued very highly by the tribes to whom they belong.

Among the minerals found in Sarawak are gold, antimony, quicksilver, and cinnabar, though the last two are, as far as we know, nearly worked out. Gold is now won by the latest scientific methods, and the gold industry is an exceedingly prosperous one. The coal-fields of Sarawak are extensive; anthracite, steam and cannel coal have been found throughout the country.

Diamonds are found in various parts of Sarawak and are of good quality. The largest known was 72 carats, and has been named the "Star of Sarawak." Diamonds at present time are only worked by natives in a desultory manner, but it seems probable that if they were systematically searched for good results might follow.

It is indeed quite possible that in the future some important find of gold or precious stones may be made in Borneo, for the greater part of the interior has been practically unexplored in this direction.

The wild animals of Borneo consist of the elephant, rhinoceros, bison, sambur deer, the kijang, a smaller variety, and also the little mouse deer, a beautiful little animal the size of a hare. There are also several varieties of wild pig. The little Malayan bear must also be mentioned: he is a jolly little fellow when young, but is uncertain of temper and very destructive if kept in the house as a pet, as many have found to their cost. The elephant only exists, so far as I know, in North Borneo, though it lived apparently at one time in Sarawak, as bones which have been identified as those of an elephant have been found. Wild cattle still exist in considerable numbers, though in Sarawak they are only found in the interior, whereas in North Borneo they are met with on the coast.

Deer are numerous all over the country, as also are wild pig. The tree leopard is occasionally met with, but is not dangerous. The tiger, though found in the Malay Peninsula and in Java and Sumatra, does not exist in Borneo.

The huge anthropoid, the "Mias" or "orang utan," is still fairly plentiful, the Government having placed a check on collectors by limiting the number they can take. It is generally a harmless, though terrible-looking beast, but has been known to attack men when interrupted by them in the work of robbing fruit groves. There are many others of the monkey tribe, including the "Brok" and the "Kra," both of which are very common. The latter is often found in the mangrove swamps, and natives state that, although a powerful swimmer, its method of crossing small creeks, which abound in these swamps, is to sink itself and walk along the bottom. The habit, if we may credit the native stories, is probably due to the fear of crocodiles, to which many monkeys fall victims, as is shown by the numbers of mutilated specimens which may be seen on the flats.

Of the cat tribe there are many varieties, the most striking member of this group being, perhaps, the binturong or bear cat. It is a medium-sized animal, about 4 ft. from nose to tail, with long black or shaggy hair sometimes tipped with white, the ears being tufted like those of the lynx. There are many specimens of the weasel tribe, and otters are numerous in the rivers.

The greatest enemy of man in Sarawak is the crocodile; this is easily understood when it is borne in mind that the roads of Sarawak are the rivers. These voracious saurians take the place of the tiger in this country as a man-eater. Possibly the first victim is taken by chance, or because the crocodile is driven to do it by want of food. Once, however, it has taken a man, it becomes a man-eater and a man-hunter. The Government offers a reward for the extermination of these pests, and a great many are brought in every year in consequence.

Excellent fish are abundant, and there are varieties of herring and mullet, also crabs, prawns and oysters.

Snakes are numerous, and yet, comparatively speaking, rarely seen.

There are said to be some 120 varieties of land and water snakes. Birds, butterflies and insects abound, and might be dealt with more fully did space permit. Borneo has been described as an "Entomological Paradise," and any traveller there would quite credit this, though he or she might not derive quite as much satisfaction from the attention of the innumerable varieties of the insect tribe as the seeker after knowledge.

But besides all this animal life one cannot recall the Borneon jungle without remembering its luxuriant vegetation, its beautiful palms and lovely orchids. Burbidge has called it "the Gardens of the Sun," and this title is fully justified. It will be as well, perhaps, before ending this short description of the country, if I try to give you some idea of what the dense jungles and waterways of Sarawak are like, though I fear that any description I can give must fall far short of the reality.

The rivers of Borneo are its roads, and indeed in most places are the only means of access to the interior. Every settlement, village or town of any importance is on a river, so that in attempting any description of Sarawak, the first thing one calls to mind are the waterways of the country. The mouths of nearly all the rivers are fringed with mangrove, which at high tide appear to be growing in the water: here and there are perhaps stretches of silvery sand with a background of palms or the graceful casuarina.

The mangrove predominates, however, until we reach the nipa palm fringe. This beautiful palm, with its feather-like fronds, is found on every river's bank as far as the influence of salt water is felt. In the delta of the rivers are innumerable waterways extending for miles and miles, all so exactly alike one another that many cases are recorded of natives having lost their way in them, and sometimes their lives. They resemble in fact a water maze, in which only the initiated can hope to find their way.

As we pass along up the river, the mangroves and nipas begin to give way to the jungle trees which now line the banks.

Still ascending, we notice that this dense jungle presents a barrier that man has only at wide intervals managed to encroach upon. Here and there we may come upon native villages, with a background of palms and emerald-green rice-fields, but beyond them again we see the dark jungle wall seeming to forbid further encroachments. As we still force our way onwards even these signs of man's presence seem to be still less in evidence, and only tiny plots of cultivated land are to be met with at long intervals, and these hardly vary the monotony of the everlasting forest wall. A few hours more and we leave the dwellings of man behind us altogether, and the river scene itself has changed. The water, before yellow and muddy, is now clear, and the bed of the river shallow, for we are nearing the rapids.

Soon, if our river is a small one, the jungle trees begin to lean over the stream, in places meeting at the top and forming an arch of greenery through which the brilliant sunshine can hardly penetrate, and indeed for long distances there is cool deep shade that would almost be gloom in any other country. Further on again we may come to a place where

the swiftly flowing river becomes pent between grim walls of stone, whilst upstanding rocks in midstream check its hitherto easy flow. But after passing this, we may find that it has again become placid and smooth, winding gently round tree-covered islands. At last the river we have followed so far becomes too small for boats, and here we must leave it, for it has probably brought us to our landing-place at the foot of the mountains, and when we have conquered these we shall be in the far interior, in a region of forest-clad hills with fertile and well-watered valleys, with a climate which, in comparison with that of the coast, is cool and invigorating. It is a country which is at present but little known, but which must surely in the future, when made accessible to civilisation, prove to be one of the most attractive countries in the Far East.

## PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

### Livingstone Gold Medal.

At a Meeting of Council held in the Society's Rooms on Thursday, 20th June, it was resolved that the Livingstone Gold Medal should be awarded to Captain Roald Amundsen for his valuable geographical discoveries in connection with his recent expedition to the South Pole. Captain Amundsen has kindly consented to open the Society's Lecture Session in Glasgow and Edinburgh on the 20th and 21st November respectively.

### Diploma of Fellowship.

The Ordinary Diploma of Fellowship was conferred on James Hutcheon, M.A., Oban, subject to his compliance with the prescribed conditions.

### Geographical Association of Scottish Teachers. Constitution.

The proposed Constitution of this Association was submitted by the Secretary, and was in its essential features cordially accepted by the Council.

### Deputation to Scotch Education Department.

In accordance with the resolution passed by the Council at their Meeting on March 12th (see page 209), Sir John Struthers was asked to receive a deputation from the Society at the Scotch Education Office. In reply to the representations put forward by the members of the deputation, Sir John Struthers stated that, while the Department were unable to make any immediate change in the regulation referred to, the question of making changes favourable to the position of Geography in the intermediate stage would be carefully considered in the future.

# GEOGRAPHICAL NOTES.

## General.

**The Scope of Geography.**—Herr Ewald Banse has been contributing to *Petermann's Mitteilungen* a series of articles under the general title of "Geography," which, though somewhat diffuse in form, contain some interesting points. He believes that geography must be defined by its method, not by its content. The only limitation of content which he recognises is that the subject is concerned with visible phenomena only, that is with objects capable of direct observation. In other words, he limits its sphere to the region included between the upper limits of the atmosphere and the solid crust of the earth, the ether and the interior of the earth being excluded. Within these limits almost any object may form part of geography—thus, he says, a pair of wooden nut-crackers, considered from the geographical standpoint, may throw a flood of light on the conditions of existence in poor mountain regions. Geography, he says elsewhere, does not concern itself with the investigation of objects as objects, but seeks to answer the following three questions in regard to places—Where is it? What are its relations and why? What are the consequences of this position and relations?

Another point upon which the author is very strong is that the ordinary division of the earth into continents is quite non-geographical and merely an inheritance from an earlier period, for these continents are not geographical entities. He suggests the division of the globe into fourteen natural regions, whose boundaries he illustrates by a map. These fourteen are—(1) Europe, which differs from the Europe of tradition in the omission of the Russian plain, that is of nearly the whole of the Russia of the maps. This converts Europe into a natural region, distinguished as the only part of the globe which is devoid of steppes and deserts. (2) Greater Siberia, which includes the Russian plain, the region round the Caucasus, and the Asiatic steppe, taiga and tundra regions. (3) Mongolia, which comprises Tibet, the Gobi region, and the mountainous part of central Asia generally. (4) East Asia, which includes Manchuria, China, etc. (5) The Indies, which includes India, Further India, and the East Indian Islands. (6) New Guinea and Australia, with New Zealand and the adjacent islands, form Greater Australia. (7) Under the head of the Orient is included that uniform region which stretches from Persia through Arabia across North Africa, and was considered in detail in Herr Banse's previous study (cf. *S.G.M.*, vol. xxvii. p. 315). (8) The whole of the rest of Africa falls under the heading of Negroland (*Negritien*). The continent of America is divided into four parts, the name America being reserved for (9) the eastern part of the United States and Canada. The western section forms (10) Greater California. Southwards, Central America, the whole of the region round the Andes throughout the length of the continent, and the Antilles form (11) Andina, while the remainder of South America is included under (12) Amazonia. The Arctic and Antarctic regions form divisions (13) and (14). The characters of each of these regions are discussed in detail.

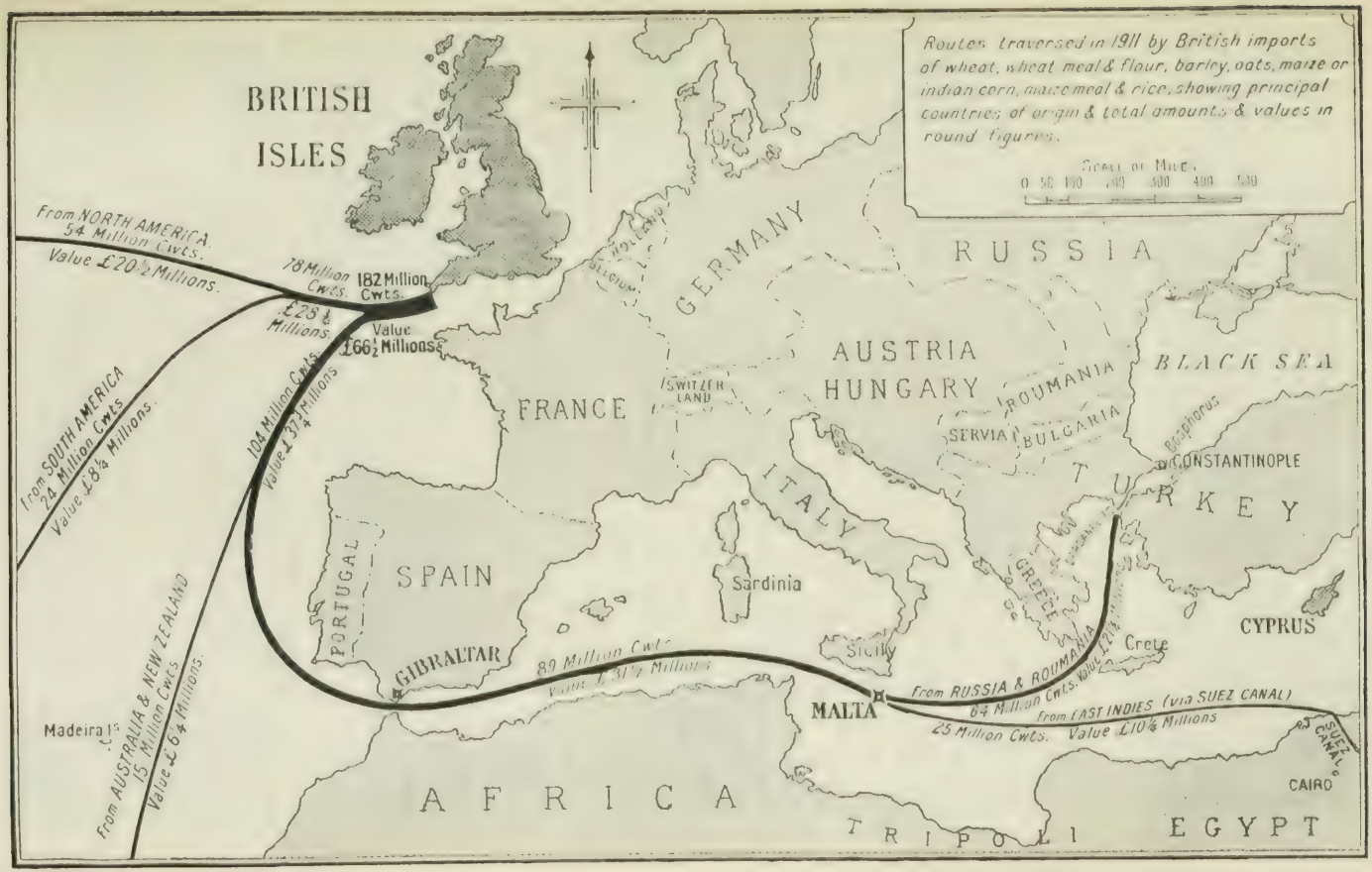
Among other interesting suggestions thrown out in the course of the lengthy discussion, it may be mentioned that the author points out that the treatment of the fauna of countries in text-books is almost never truly geographical. Thus the existence of lions in Africa is emphasised in all text-books, though the real importance of this animal is very small, and very much less than that of tsetse-flies or mosquitoes. Generally he maintains that for the geographer the invertebrates of a country are of far more importance than the wild vertebrates. As a statement this is no doubt extreme; for example, it is stated that in the French Congo the presence of elephants in a given area excludes human groups (cf. *S.G.M.*, vol. xxvi. p. 489) owing to the destruction wrought by these animals in the plantations; nevertheless the statement is of value in calling attention to facts not as yet sufficiently emphasised. Among other paradoxes thrown out by the author is the assertion that geography resembles philosophy in having no directly practical importance, and that, like that subject, in becoming practical it loses its essential features.

## Commercial Geography.

**The Carriage of Canadian Wheat.**—A very curious little point in regard to commercial geography is shown by the annual canal report issued by the Canadian Government. This is that during the past year nearly half the wheat which came down by water from the Canadian West found an outlet to Europe *via* Buffalo and New York, instead of by Montreal. Only 54·8 per cent. of the total wheat went by Canadian channels, compared with 68·6 per cent. in the previous year, and this despite the fact that the rate from Fort William to Montreal is only half that to New York. The reason given is that at New York a larger amount of ocean tonnage is available, the rates to Europe are lower, and the insurance rate is lower.

**Sources of our Food Supply** (*With Sketch-Map*).—The accompanying diagram, published by kind permission of the Editor of the *Times*, shows in a very instructive fashion the country of origin of our supplies of flour, wheat, and other cereals. These substances, though forming only about six per cent. in value of the total trade of the British Islands, are of course supremely important as the basis of the national food supply. The first point of interest is that, owing to the wide range in latitude of the countries supplying us, the traffic in these substances goes on almost continuously throughout the year, though on the whole there is more British food on the high seas in summer than in winter. The writer of the *Times* article gives it as his opinion that the ships carrying the supplies average about 5000 tons, and have an average speed of about ten knots, so that in journalistic language they are neither leviathans nor greyhounds. The diagram shows that the ports of the Black Sea are the chief source of supply, North America coming second, and being followed in order of importance by the East Indies, South America and Australasia. The result

MAP TO ILLUSTRATE THE ROUTES TAKEN BY FOOD IMPORTS.



is that half the total supply comes through the Mediterranean Sea. So much stress is commonly laid upon the importance of North America as the granary of the western world, that it seems important to indicate by means of a diagram the fact that for us Russia and the Balkan States are more important, and that the East of Europe still remains largely unaffected by that great change which has made Western Europe a region of manufactures rather than of agriculture.

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## EDUCATIONAL.

Geographical Teaching in Upper Classes in Schools.—We learn from the *Kartographische u. Schulgeographische Zeitschrift* (see *S.G.M.* p. 150), that the problems which are vexing teachers here are just as clamant in Austria. Geographers there have succeeded in obtaining one hour per week in the Fifth and Sixth Forms of the Realschulen for the subject—not a very liberal allowance. The concession is accompanied by a programme rich in generalities. The teachers are to use this solitary hour to broaden and deepen the scholar's appreciation of the causal relations of geographical conditions; they are to impart a deeper understanding of political relationships; to give an insight into the connection between the physical conditions of a country and the social development of its people, especially in relation to economic geography; they are also to discuss the elements of the related sciences in so far as these are necessary for the comprehension of geographical facts, and in so far as they are within the reach of the scholar. The author of the article from which we quote, Dr. Alois Müller, not unnaturally says that at first sight it would seem that Sisyphus' task was light compared with that of the geographical teacher. Obviously amid this welter of recommendations the teacher must select some special branches of the subject to which he may devote his strictly limited time. Dr. Müller recommends two lines of instruction. In the first place it is, he says, possible to use the geographical hour to explain and illustrate the facts of human history, as the pupil obtains them in his other classes. He illustrates by a comparison of the history of Greece and Rome as determined by the differences in form and relations of the two peninsulas concerned, the deeply dissected, island-begirt peninsula of Greece leading as necessarily to the multiplication of minor states, as the compact and more uniform peninsula of Italy led to a homogeneous one. This is a line of teaching which we need not develop further, however, for Prof. Myres is an eloquent exponent of it in this country, and readers of the *Magazine* have already had an opportunity of perusing some of his work.

The other aspect of higher geography which the author discusses is that of Commercial Geography. Here he attacks vigorously the old, and largely disappearing type which consisted in learning lists of exports and imports, towns, products, and so forth. He goes even further, however, and maintains that for school geography the economic

side of the subject should not be separated from the physical side. Lands and countries should, he thinks, be treated as a whole, topography, climate, forms of vegetation, man in his varied activities, all being discussed so as to form a complete picture of the particular region under discussion, as is, of course, done in the more modern text-books. To ensure this being carried out successfully he has great faith in lantern demonstrations, based upon scientific journeys, the material, pictorial and other, being collected directly from actual travels, etc. In this way the text-book is relegated merely to the position of a book of reference, and the scholar depends upon his atlas, wall-maps, and the impressions gained from the lantern slides arranged to represent the supposed journey. Though often laborious for the teacher the method, he finds, yields excellent results, if the fact that the object is instruction be rigidly kept in view, and the teacher does not allow the lesson to degenerate into a mere show of pictures. Two obvious objections, the amount of time spent, and the cost, he meets, as it seems to us, successfully—quoting, for example, some remarkably cheap rates for lantern slides. There seems no doubt that this journey method, if carefully and comprehensively carried out, is capable of yielding very good results.

Among other interesting articles in this the April issue of the *Zeitschrift*, we notice one, illustrated by a fine map, on the development of the town of Salzburg, which contains some interesting facts, and another, also illustrated, on methods of indicating altitude limits on mountains. One of the illustrations here is a sketch-map of the Ortler group, showing the altitude limit of corn and forest, and the snow-line in the different valleys of the group, the whole forming a very suggestive diagram.

## NEW BOOKS.

### EUROPE.

*The Survey Atlas of Scotland.* A Series of Sixty-eight Plates of Maps and Plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Historical, Political or Commercial Features of the Country. Designed and prepared under the direction of J. G. Bartholomew, LL.D., F.R.S.E., F.R.G.S. The Edinburgh Geographical Institute, 1912. *Price* £2, 2*s. net.*

The new edition of this beautiful atlas shows a considerable number of modifications and improvements as compared with its predecessor, published in 1895. Eight representative maps from Blaeu's Atlas of 1654 have been added to the contents, and are of much historical interest. The text has also been revised, the more recent observations made by the members of the Geological Survey being, for example, summarised in Sir Archibald Geikie's article on the Geological Formations. A minor change, but one which will be greatly appreciated by all those who have occasion to use the atlas constantly, is the printing of an index to the section maps on the back of each plate containing a section, and the numbering of the sections according to the plates on which they occur. This greatly facilitates reference to the different sections, which were not easy to find in the

first edition. Among other additions are a useful motoring road-map, one of the railways, and a sketch-map showing the glaciation of Scotland. The atlas thus gives a most comprehensive view of the geography of Scotland, and is invaluable to students.

*The Normandy Coast.* By Charles Merk, English Chaplain at Dieppe. The County Coast Series. London: T. Fisher Unwin, 1911. *Price* 6*s. net.*

The publisher has added this volume on Normandy to his County Coast Series, no doubt feeling that his action is justifiable both on account of the ready accessibility of this coast to the inhabitants of south-eastern England, and because of its wealth of historical association, no less than its natural beauty. Mr. Merk has, it is stated, resided in Normandy for a prolonged period, and he gives a very full account of its charms, natural and artificial, illustrating his text by some very fine plates. The view of Mont St. Michel is particularly attractive. While the text is chiefly descriptive and historical, the author gives numerous hints as to inns, and the tourist will find the book of much use in planning a holiday in this interesting region.

*Seaside Resorts of Brittany: From Mont Saint Michel to Saint Nazaire.* Joanne Guide Books. English Series. Paris: Hachette and Co., 1912. *Price* 4*s.* or 5 *fr.*

This is a useful little guide-book presenting the usual features of the Joanne series. Our chief objection to it is that, as in the French issues, the book is needlessly swollen by many advertisements. However the tourist moves about, one of his objects is always to reduce needless luggage, and our own experience of Joanne guides is that their fate is either to be torn up, or, if the owner be orderly, to be re-bound minus the advertisements. In the present volume the small illustrations in the text form a pleasant feature, but 182 pages of advertisements to accompany 254 pages of text seems to us a little unreasonable.

*Burgundy: The Splendid Duchy.* By Percy Allen. London: Francis Griffiths, 1912. *Price* 12*s.* 6*d. net.*

Those of our readers who have read Mr. Percy Allen's *Impressions of Provence* (*S.G.M.*, vol. xxvi. page 433) will know what to expect in this work. Again the writer seems to have imbued himself with the spirit of the land in which he wanders, and we have a series of delightful sketches of such famous places as Autun, Cluny, Citeaux, Dijon, etc. Mr. Allen has made a diligent study of the romantic, secular and ecclesiastical history of the country, and recounts with much charm and literary skill many well-known stories, such of those of St. Bernard, Abélard and Héloïse, Louis xi. the Crafty and Duke Charles the Bold, in addition to which we have curious local legends and stories, which are of great interest as illustrating the history of the places and character of the people. He is an expert in describing ecclesiastical architecture, and in this he is ably assisted by the excellent illustrations of Marjorie Nash. The natural beauties of the scenery receive appreciative notice. "Nature, too, has her pageant in this best garden of the world," she will hold you here, whether you choose the delicious, poplar-fringed plains of the Saône, the "waterish" Burgundy that the French king swears at in *Lear*—he would have gloried in the land had it been his own—or the stern and silent hills of the Jura and the Morven; or the vine-clad slopes of sunny Côte d' Or." Of the people he says "you will find a country well typified by its wines, its sculpture, its architecture—a solid, ample, full-bodied,

full-blooded land ; a people strong and vivacious, concealing, beneath a somewhat harsh exterior, a cheerful heart and an abundant generosity, comfortable, courageous, eloquent, sonorous folk, that love a good dinner, and a good story to follow, that have produced a Bernard, a Bossuet, and a Lamartine." We sincerely hope that Mr. Allen will be able to keep his promise, and produce for Northern Burgundy as interesting a volume as he has done for Southern Burgundy.

*The South Wales Coast: From Chepstow to Aberystwyth.* By Ernest Rhys. The County Coast Series. London: T. Fisher Unwin, 1911. *Price* 6*s. net.*

Mr. Rhys has been fortunate in the piece of coast which has fallen to his lot, for the region described is full of objects of interest, from the many castles to the localities round which the various Arthurian legends cluster. His interest in these has perhaps led the author to neglect associations nearer at hand ; thus we can find no allusion to Philip Henry Gosse, the naturalist, in connection with Tenby, and yet to many this is the strongest association with that place. Further, though the curious and rare plants of South Wales are mentioned, we do not find any accounts of the geological structure of the splendid cliffs for which the coast is famous, and this despite the fact that the Welsh coast is of great geological importance. But the author writes doubtless for a public interested in scenery and legend rather than in technical details.

*North Uist: Its Archæology and Topography.* With Notes upon the Early History of the Outer Hebrides. By Erskine Beveridge, LL.D. With 150 full-page Illustrations and 2 Maps. Edinburgh: William Brown, 1911. *Price* 30*s. net.*

This very handsome volume, forming a companion to the same author's *Coll and Tiree*, gives a most interesting account of North Uist, and its beautiful illustrations indicate very clearly the salient characteristics of the region. The chapter on the topography, climate, and vegetation contains much of great geographical interest. While indigenous trees are now virtually absent, as in the other islands of the Outer Hebrides, yet it is noted that specimens of the mountain ash are found, though they never reach a height of more than six feet. Alders and aspens also grow, and on the drier moorland juniper occurs, though it never exceeds a height of about three inches. But at least two place-names bear evidence to the former existence of woods in North Uist, and tree roots and hazelnuts occur in the peat-bogs, as well as on the shore in some places. A very full account is given of the remains of North Uist, both pre-historic and later ; the large folded map at the end indicates the position of all forts, chapels, etc.

## ASIA.

*The New China: A Traveller's Impressions.* By Henri Borel. Translated from the Dutch by C. Thieme. London: T. Fisher Unwin, 1912. *Price* 10*s.* 6*d. net.*

This book might more properly be called Impressions of Peking, because it treats entirely of the author's visit to the capital of China. He is a Dutchman who describes himself as artist and poet, and he tells us that he avails himself of the poet's right to give a chain of personal and subjective impressions. This he does in picturesque fashion, and with a facile pen. To him, the whole of Peking is one great religious symbolism, and, speaking as an artist, he says he has "tried to give an idea of the wisdom and beauty that are the expression of the Chinese

soul." His visits to the temples and palaces, of which we have some genuinely fine descriptions, furnish a text for poetical rhapsodies in which the mysteries of the cult of esoteric Buddhism figure largely. The author believes that learned diplomatists and sinologues will find in his book food for laughter; which is not unlikely, if it should come under the notice of these exalted persons; and we imagine there are a good many plain folk, to whom Peking with its temples and palaces are well known and familiar objects, who would be considerably astonished to read the impressions recorded by Mr. Borel. He is himself a sinologue, being an official Chinese interpreter in the Dutch East Indies; and he confesses to having laid his own Dutch translation of the works of Confucius before the tablet of the Sage in the latter's temple at Peking.

Mr. Borel is an optimist as regards the future of the reform movement in China, and he furnishes some interesting and illuminative notes in the chapter which deals especially with this subject. He points out that, by the end of the year 1909, there were some 40,000 modern schools scattered throughout the empire, and new ones have been springing up like mushrooms in the interval. Temples have been pulled down to make room for them, and there has been a rush of the younger generation, keen to learn. A great deal of the teaching is necessarily very imperfect at present, but it is vain to expect that a sufficient body of native teachers, trained in western science, should spring into being in the short time which has elapsed since the reform movement was begun, while the fighting and disorder incident to the revolution have checked and retarded the movement. Mr. Borel writes:—"How this reform will proceed, whether it will develop itself gradually, or—what is very probable—bloody revolutions and wars will push it forward with big, brutal leaps, seems to me only of secondary importance. To me the principal thing is that the history of the world will, surely and certainly, behold an Eastern race, comprehending more than one fourth of the population of the earth, develop itself into civilisation and self-consciousness."

Without being censorious we may perhaps fairly take exception to Mr. Borel stigmatising our Indian soldiers, who were the first to come to the relief of the beleaguered Legations in 1900, as "savage British-Indian troops," while, to the initiated, the repeated references to Mr. Putnam Weale's *Indiscreet Letters from Peking* will seem like an appeal to a somewhat doubtful authority. But these are only blemishes on a book which on the whole well repays perusal.

## AFRICA.

*About Algeria.* By Charles Thomas-Stanford, F.S.A. London: John Lane. New York: John Lane Company, 1912. *Price 5s. net.*

The principal feature of this book is found in the illustrations, which are of exceptional merit. For the rest, it is a pleasantly written series of sketches of the principal towns in Algeria, with interesting notices of their history, ancient and modern, and of the curious conglomeration of people who now inhabit them. The writer dilates on the excellence of the roads and communications, which are the work of the French, and are particularly well adapted for motor traffic.

*The Tailed Headhunters of Nigeria.* By Major A. J. N. Tremearne, M.A. (Cantab.), F.R.G.S., F.R.A.I. London: Seeley, Service, and Co., Limited, 1912. *Price 16s. net.*

If the British public are not by this time well acquainted with the political, economic, and administrative conditions of Nigeria, it is certainly not the fault of

the able and zealous band of officers who serve in that Protectorate. Within a short time we have had two thoughtful and instructive works by Dr. Falconer, one by Captain Orr, one by Mr. Dennett, and one by Mr. Morel, all dealing with the history, conditions, and problems of Nigeria. To these we have now to add a sixth by Major Tremearne, already well known as the author of *The Niger and West Sudan*. In this new work he tells of his experiences in what is known as the Pagan Belt of Northern Nigeria, *i.e.* the provinces of Nassarawa, Zaria, Bauchi, Yola, Muri, Bassa, and Kabba, the tracts through which the Benue river runs. These tracts indeed cannot as yet be pronounced quite subdued, as the tribes, or some of them, are still turbulent and unruly, and still practise cannibalism and headhunting as far as it is safe to do so. The book takes its title from a strange custom of the women of the Kagors, Attakka, Moroa, Katab, Kajji, and Jaba tribes. "Instead of the girdle, married women wear a tail behind, which has various names according to whether it is decorated or not, but is in its most primitive form called *kumok*; this is in shape something like a mushroom, some being long and thin, others being short and stumpy. It is made of a palm fibre, very tightly drawn together and bound with string, and, except in the southern Kagoro towns, there is a wider, wheel-shaped end, plaited like basket work, the whole being left quite plain, or coloured red with earth to match the wearer's body. The next step in ornamentation in some parts is a row or two of beads around the edge of the "wheel," and brass wire may be bound round the "stalk" or "axle" of the *kumok*, or it may be covered with sheet brass. Finally, the under-surface of the "wheel" may be decorated with coloured glass beads in a more or less regular pattern, and the two strings binding the tail to the waist may be thus adorned also. When a girl has been married, her mother removes her girdle, and a small branch or bunch of leaves is hung in front to the string around the waist which supports the tail behind. No women of these tribes would dare to attire herself in any but the prescribed fashion, though the only punishment which would be inflicted is the disapproval of her own people." Major Tremearne spent seven years in Northern Nigeria as a police officer, and it must be remembered that the duties of police officers in Nigeria are more political than police: and his work brought him into more direct contact with the savage tribes than usually falls to the lot of a civil officer. He claims for his book that it is "a true and living picture of life," and a perusal of it shows that he had prepared himself for his work of observation and comparison by extensive reading and study of anthropology, and that he spared no pains to inquire about and record what he saw. The book is well illustrated with many excellent photographs, and the narrative contains many amusing episodes of personal incidents and adventures, some of them involving very considerable danger. We gladly recommend the book to the perusal of our readers.

## AMERICA.

*Distribution and Origin of Life in America.* By Robert Francis Scharff, Ph.D., B.Sc., author of "European Animals, their Geological History and Geographical Distribution." London: Constable and Company, Ltd., 1911. *Price* 10*s.* 6*d. net.*

Throughout the greater part of this volume Dr. Scharff has an irritating habit of saying: "But I shall refer to this subject later on." Now once in a while it is impossible to avoid mentioning a topic in passing while deferring full treatment, but deliberately and avowedly to make a practice of catching theories and letting them go again is apt to lead to confusion, at least on the part of the hapless reader. To

get at Dr. Scharff's own view, for instance, of former land connections between the new and the old worlds it is necessary to piece together odd paragraphs from many pages. Even with the help of an excellent index this process is wearisome, and indeed we do not see why a reader should be called upon to undergo it. Compression and avoidance of repetition are all very well, but surely such important conclusions as those to which the author comes are worthy of complete statement in one place. This preliminary grumble over we are free to confess that the book is a fascinating one. Doubtless the fires of controversy will rage, for he is a bold man who ventures to dispute the long-established theory of the permanence of the existing ocean deeps. It is a theory not lightly to be overturned, for it explains satisfactorily the present distribution of land and sea, and the scope of Dr. Scharff's volume does not include the putting forth of an alternative. A brief notice like this is not the place for entering upon this controversial subject, but might we just mention one point? The author postulates two bridges from Africa, one to the West Indies, the other by St. Helena to South America. He states that in no other way can the distribution of certain tropical forms be explained. Now it is admitted that Antarctica was once joined to Africa and to South America, and that the climate of Antarctica was at least warm temperate, if not sub-tropical. Could that not provide the necessary land connection?

*Captain Cartwright and his Labrador Journal.* Edited by CHARLES WENDELL TOWNSEND, M.D., author of "Along the Labrador Coast," etc. etc. With an Introduction by Dr. WILFRED T. GRENFELL. Illustrations from old Engravings, Photographs, and a Map. London: Williams and Norgate, 1912. *Price 5s. net.*

Dr. Townsend has rendered good service by publishing this admirable selection from Cartwright's classic journal. The original has not been tampered with in any way except by the omissions necessary for purposes of compression, and we have a faithful picture in the gallant captain's own words of life on the Labrador in the latter half of the eighteenth century. A copy is given of the chart which originally appeared in the journal, and the various localities are illustrated by photographs. Captain Cartwright was an adventurer, in the best sense of the word, who reminds one of Elizabethan rather than of Georgian times. The style of his journal is full of manly simplicity and candour, and we cordially recommend this edition to the reader who likes occasionally to transport himself back to the good old days.

## BOOKS RECEIVED.

*Man and his Conquest of Nature.* By MARION I. NEWBIGIN, D.Sc. (Lond.), containing 24 Illustrations. Crown 8vo. Pp. viii + 183. *Price 2s.* London: Adam and Charles Black, 1912.

*Guiana: British, Dutch, and French.* By JAMES RODWAY, F.L.S. With a Map and 36 Illustrations. Demy 8vo. Pp. 318. *Price 10s. 6d. net.* London: T. Fisher Unwin, 1912.

*The Oxford Country: its Attractions and Associations.* Described by several Authors. Collected and arranged by R. T. GÜNTHER. Crown 8vo. Pp. xvi + 319. *Price 7s. 6d. net.* London: John Murray, 1912.

*Physiologische Morphologie.* Von Prof. Dr. S. PASSARGE. Mit 1 Originalkarte und 17 Originalabbildungen. Demy 8vo. Pp. 205. Hamburg: L. Friederichsen und Co., 1912.

*Across Australia.* By Baldwin Spencer, C.M.G., M.A., F.R.S., and F. J. Gillen. 2 Volumes. With Illustrations and Maps. Demy 8vo. Pp. xiv + 515. *Price* 21*s. net.* London: Macmillan and Co., Ltd., 1912.

*Sur la Diversité Génétique des Montagnes Éruptives.* Par A. Stübel. Traduit de l'allemand par W. Prinz et C. Van de Wiele. 4to. Pp. 70. Bruxelles: Académies Royales de Belgique, 1911.

*In South Central Africa: Being an Account of some of the Experiences and Journeys of the Author during a stay of six years in that Country.* By J. M. Moubray, F.R.G.S. With Maps and Photographs by the Author. Demy 8vo. Pp. xvi + 193. *Price* 10*s.* 6*d. net.* London: Constable and Co., 1912.

*Italy's War for a Desert: Being some Experiences of a War-Correspondent with the Italians in Tripoli.* By Francis M'Cullagh. Demy 8vo. Pp. xxxvi + 410. *Price* 10*s.* 6*d. net.* London: Herbert and Daniel, 1912.

*Handbook to Belgium, Including the Ardennes and Luxemburg.* With Map of Belgium and Plans of Brussels, Antwerp, Ostend, Bruges, Ghent, Liége, Malines, Namur, Spa, and Environs, Luxemburg, the River Meuse, the Battle of Waterloo, etc. With 60 Illustrations. Sixth Edition. Revised and Enlarged. *Price* 2*s.* 6*d. net.* London: Ward, Lock and Co., Ltd., 1912.

*The Story of Santiago de Compostela* (The Mediaeval Town Series). By C. Gasquoine Hartley (Mrs. Walter M. Gallichan). Illustrated by Frank H. Mason, R.B.A. Crown 8vo. Pp. xii + 332. *Price* 4*s.* 6*d. net.* London: J. M. Dent and Sons, Ltd., 1912.

*Cambridge County Geographies.*

*Renfrewshire.* By Frederick Mort, M.A., B.Sc., F.G.S.

*Dumfriesshire.* By J. K. Hewison, M.A., D.D.

*Perthshire.* By Peter Macnair, F.R.S.E., F.G.S.

With Maps, Diagrams, and Illustrations. Crown 8vo. *Price* 1*s.* 6*d. each.* Cambridge: University Press, 1912.

*Biarritz and the Basque Country* (Joanne Guide Books—English Series). 4 Plans, 4 Maps, 40 Illustrations. *Price* 3*s.* London: Hachette and Co., 1912.

*Switzerland: A Practical Guide* (Grieben's Guide Books, Vol. 123). Second Edition. With 7 Maps. *Price* 3*s. net.* Berlin: Albert Goldschmidt, 1912-1913.

*Tramps Through Tyrol: Life, Sport, and Legend.* By Frederick Wolcott Stoddard. With 30 Illustrations and a Map. Demy 8vo. Pp. x + 298. *Price* 7*s.* 6*d. net.* London: Mills and Boon, 1912.

*In Château Land.* By Anne Hollingsworth Wharton. With 25 Illustrations. Crown 8vo. Pp. 390. *Price* 8*s.* 6*d. net.* London: J. B. Lippincott Co., 1912.

*The Great Marquis of Montrose.* By Mrs. Hugh Pryce. Demy 8vo. Pp. xv + 414. *Price* 10*s.* 6*d. net.* London: Everett and Co., 1912.

*Views and Reviews. From the Outlook of the Anthropologist.* By Sir Harry Johnston, G.C.M.G., K.C.B., D.Sc. Crown 8vo. Pp. 314. *Price* 3*s.* 6*d. net.* London: Williams and Norgate, 1912.

*Tripoli and Young Italy.* By Charles Lapworth in collaboration with Miss Helen Zimmern. Demy 8vo. Pp. 347. *Price* 10*s.* 6*d. net.* London: Stephen Swift and Co., 1912.

*The Flora of Banffshire.* By William G. Craib, M.A. Post 4to. Pp. 111. Banff: Banffshire Field Club Transactions, 1912.

*Pygmies and Papuans. The Stone-Age To-Day in Dutch New Guinea.* By A. F. R. Wollaston. With Appendices by W. R. Ogilvie Grant, A. C. Haddon, F.R.S., and Sidney H. Ray. With Illustrations and Maps. Demy 8vo Pp. xxiv + 352. *Price* 15*s. net.* London: Smith, Elder and Co., 1912.

*Cambridge Geographical Text Books: Intermediate.* By A. J. Dicks, B.A., B.Sc. Crown 8vo. Pp. xi + 362. *Price* 3*s.* Cambridge: University Press, 1912.

*To Kulu and Back.* By M. C. Forbes. With Two Maps. Fcap. 8vo. Pp. 160. *Price* 5*s. net.* Simla: Thacker, Spink and Co., 1911.

*Gaelic Place-Names of the Lothians.* By John Milne, LL.D. Demy 8vo. Pp. viii + 81. *Price* 2*s.* 6*d. net.* Edinburgh: M'Dougall's Educational Co., Ltd., 1912.

*Our own and other Lands: The World.* Crown 8vo. Pp. 380. *Price* 2*s.* Edinburgh: M'Dougall's Educational Co., Ltd., 1912.

*Norway, Sweden and Denmark, with Excursions to Iceland and Spitsbergen, Handbook for Travellers.* By Karl Baedeker. With 62 Maps, 42 Plans and Ground Plans, and 3 Panoramas. Tenth Edition. Revised and Augmented. *Price* 8*s. net.* Leipzig: Karl Baedeker, 1912.

*Studies in Bird Migration.* By William Eagle Clarke. With Maps, Weather Charts, and other Illustrations. Two vols. Demy 8vo. Pp. vol. i. vii + 346. Pp. vol. ii. xvi + 323. *Price* 18*s. net.* London: Gurney and Jackson, 1912.

*Exploration Archéologique de Délos.* Faite par l'Ecole française d'Athènes sous les Auspices du Ministére de l'Instruction Publique et aux Frais de M. le Duc de Loubat, et Publiée sous la Direction de Théophile Homolle et Maurice Holleaux. *Description Physique de l'Ile de Délos.* Première Partie. Par Lucien Cayeux. Royal 4to. Pp. 216. Paris: Fontemoing et Cie, 1911.

*Statistical Abstract for the Principal and other Foreign Countries in Each Year from* 1899 *to* 1909-10. Thirty-seventh Number. *Price* 1*s.* 11*d.* London: His Majesty's Stationery Office, 1912.

*The New Zealand Official Year Book*, 1911. Twentieth Year of Issue. Wellington, New Zealand, 1911.

*Progress of the Tide in Deep Inlets and Ordinary Estuaries.* By W. Bell Dawson, M.A., D.Sc., M.Inst.C.E., F.R.S.C. Ottawa: Royal Society, 1912.

*The Second Danish Pamir Expedition conducted by O. Olufsen: The Languages Spoken in the Western Pamir (Shugnan and Vakhan).* By A. Hjular. Copenhagen: Nordisk Forlag, 1912.

*Meteorological Notes.* By J. I. Craig, M.A., F.R.S.E. Alexandria: Société de Publications Egyptiennes, 1912.

*Diplomatic and Consular Reports.*—Trade of the Cape Verde Islands, 1911 (4847); Trade of the Consular District of Batoum, 1911 (4849); Trade of the Consular District of Baltimore, 1911 (4853); Trade and Shipping of the District of Rotterdam, 1911 (4856); Finances of the Netherlands, 1910-11, 1911-12 (4857); Trade of Nicaragua, 1910 (4859); Trade of the Port of Kiungchow (Hoihow), 1911 (4860); Trade and Commerce of the Canary Islands, 1911 (4862); Trade of the Consular District of Yucatan, 1911 (4864); Trade of Réunion, 1911 (4865); Trade and Industries of the Consular District of Corunna, 1911 (4866); Trade of the Consular District of Genoa, 1911 (4858); Trade of Chinkiang, 1911 (4861); Trade and Commerce of Beirut and the Coast of Syria, 1911 (4863); Trade of the Piræus Consular District, 1911 (4868); Trade, Commerce, etc., of New Jersey, Rhode Island, and Connecticut, 1911 (4869); Trade of the Consular District of Patras, 1911 (4870); Trade and Commerce of Sicily, 1911 (4871); Trade and Commerce of the Consular District of Havre, 1911 (4872); Trade and Commerce of the Consular District of Vera Cruz, 1911 (4873); Trade and Commerce of the Azores, 1912 (4874); Trade and Commerce of Ciudad Bolivar, 1911 (4875); Trade of the Consular District of Bahia, 1911 (4876); Trade of the Consular District of

Bordeaux, 1911 (4877); Trade and Commerce of Hungary, 1911 (4878); Trade and Shippings of the Netherlands, 1910-11 (4879); Trade of the Portuguese Possessions in East Africa, 1911 (4881); Trade of the Cyclades, 1911 (4882); Trade, Commerce, and Navigation of Cochin-China, 1911 (4883); Trade of the Consular District of Mosul, 1911 (4885).

*Diplomatic and Consular Reports, Miscellaneous Series.*—Report on the New Scheme of the Belgian Government for the Extension of the Port of Antwerp (681).

*Publishers forwarding books for review will greatly oblige by marking the* price *in clear figures, especially in the case of foreign books.*

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**GEOLOGICAL SURVEY OF SCOTLAND.**—The following publications were issued from 1st to 31st May 1912:—

Memoirs of the Geological Survey of Great Britain. Palæontology.—Vol. I. Part iii. Pp. 135-195. Plates XIV.-XVI. The British Carboniferous Trepostomata. By G. W. LEE, D.Sc. Price 3s.

**ADMIRALTY CHARTS, SCOTLAND:—**

**Scotland.** North and East Coasts, with the Orkneys and Shetland. New edition, with additions and corrections to 1909. Published 1912. Number 2397b. Price 4s. 6d.

**Aberdeen Harbour.** New edition, 1912. Number 1446. Price 2s.

*Admiralty Office, London.*

**IRELAND.**—Bartholomew's Quarter-inch to Mile Map. With Orographical colouring and roads. Sheet 2.—Belfast and North-eastern Counties. New edition, 1912. Price 1s. 6d. Mounted on cloth 2s.

*John Bartholomew and Co., Edinburgh.*

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**CANADA—NORTHERN ALBERTA.**—Homestead Map. Scale 1 : 792,000, or 12½ miles to an inch. 1912. *Department of the Interior, Ottawa.*

An interesting map showing the characteristic features of the land and the extent to which it is settled at the present date.

**UNITED STATES SURVEY.**—Topographic Sheets on Scale of 1 : 31,680, or about 2 inches to a mile. 1911. Price 5 cents each sheet. The figures after the name of each State indicate the number of sheets received. California, 10; Louisiana, 1.

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Topographic Sheets on Scale of 1 : 125,000, or about 2 miles to an inch. California, 2; Colorado, 2; Idaho, 3; North Dakota, 1; Oklahoma, 2; Virginia, 1; Wyoming, 4.

Topographic Sheets on Scale of 1: 250,000, or about 4 miles to an inch. Alaska, Yukon Region, 1; California, Sacramento Valley, 1: Nevada, 1.

General Base Map, Scale 1 : 7,000,000. New Edition, 1911.
General Contour Map, do. do.
General Relief Map, do. do.

*United States Geological Survey, Washington, D.C.*

## AFRICA.

**AFRICA.**—Political Map of ——. By J. G. Bartholomew, LL.D., F.R.G.S., 1912. Scale 1 : 12,000,000. With enlarged inset Maps. Mounted on cloth. Price 2s. net. *John Bartholomew and Co., Edinburgh.*

This new edition, revised to date, shows all recent explorations, together with frontier changes and new railways.

**CONGO BELGE.**—Petit Atlas du ——. XVI Cartes en couleurs, avec cartes et diagrames en noir. 1912.

*Maison d'Edition Albert de Boeck, Bruxelles.*

A useful little atlas showing physical, political, and economic aspects of the Belgian Congo. There are also six section maps on the Scale of 1 : 6,000,000.

**SOUTHERN AFRICA.**—Bacon's Map of ——. Scale 1 : 4,815,000, or 77·6 miles to an inch. 1912. *G. W. Bacon and Co., Ltd., London.*

This map extends as far north as Lake Tanganyika, and includes the whole of British South Africa. As a political map it is scarcely up to date, as it shows the old provinces of North-Western and North-Eastern Rhodesia, instead of the new territory of Northern Rhodesia.

**KAMERUN.**—Karte in 31 Blätter und 3 Ansatzstücken im Massstabe von 1 : 300,000, bearbeitet unter Leitung von Max Moisel. Im Auftrage und mit Unterstützung des Reichs-Kolonialamts, 1912. Blatt D 4, Rei-Buba; Blatt D 5, Kagopal; Blatt E 5, Kulungalu; Blatt F 5, Bosum; Blatt G 5, Makandschia; Blatt H 5, Lopi; Blatt I 5, Ikelemba; Blatt K 5, Bonga. Price M. 2 each sheet. *Dietrich Reimer (Ernst Vohsen), Berlin.*

The recent transfer of territory to the German Kameruns from the French Congo has necessitated the addition of eleven new sheets to this official map. The large scale of the maps shows very clearly how very imperfect is the knowledge of these regions.

**TRIPOLITANIA E CIRENAICA.**—Grande carta semi-murale a colori, alla scala di 1 : 2,500,000, con carte speciali della Tripolitania e della Cirenaica alla scala di 1 : 1,000,000 ed una carta particolareggiata del Bacino del Mediterraneo. Costruita e disegnata da Achille Dardano. 1912. Prezzo L. 2.

*Istituto Geografico de Agostini, Novara.*

A most excellent map of this new Italian province. It shows land surface features very effectively, and the more important parts of the country are given on an enlarged scale.

**MAR ROSSO e Possedimenti Italiani in Africa.**—Scala media 1 : 4,500,000. 1912. Prezzo L. 0.80. *Istituto Geografico de Agostini, Novara.*

A hydrographic map of the Red Sea showing depths and lighthouses. With inset showing Italian possessions in Africa.

## ASIA AND GENERAL.

**CHINA.**—Showing Railways, Telegraphs and Treaty Ports. Scale 1 : 5,000,000. New edition, 1912. With notes and statistics on railways. Price 1s. 8d. *Geographical Section, General Staff, London.*

This map shows all the latest schemes of railway and commercial development in China.

**WORLD, MAGNETIC CHART.**—Curves of Equal Magnetic Variation, 1912. Reduced to that epoch from observations at sea, made chiefly by the Officers of His Majesty's Navy, and from various Magnetic Surveys undertaken by Colonial and Foreign Governments, 1905 to 1911. Number 2598. Price 4s. *Admiralty Office, London.*

## NEW ATLASES.

**ATLAS UNIVERSEL DE GÉOGRAPHIE.**—Commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. No. 52. Inde Nord-Est et Tibet. Echelle de 1 : 5,000,000. 1912. Price 2 francs each map. *Librairie Hachette et Cie, Paris.*

Monsieur Schrader is to be congratulated on the completion of this great atlas begun no less than forty years ago. In the first number of the *Scottish Geographical Magazine* we noticed the fourth part, and from time to time we have reviewed the various maps as they appeared. If the work has not been carried out with much expedition, it certainly merits the highest praise for thoroughness and perfection of cartographic execution. As it has not the advantage of being presented as a complete up-to-date work, it cannot well be compared with other world atlases, but it is undoubtedly the finest atlas that France has yet produced.

**CALENDARIO-ATLANTE DE AGOSTINI.**—Anno ix., 1912. Con note geografico-statistiche del Prof. Dr. A. Machetto. Price, lire 0,80. *Istituto Geografico de Agostini, Novara.*

A neat little pocket atlas of the world containing 22 plates with general index, geographical statistics, and a calendar for the year.

**THE SURVEY ATLAS OF SCOTLAND.**—A series of 68 plates of maps and plans, with descriptive text, illustrating the Topography, Physiography, Geology, Climate, and the Historical, Political, and Commercial Features of the Country. Designed and prepared under the direction of J. G. Bartholomew, LL.D., Cartographer to the King, 1912. Published under the Patronage of the Royal Scottish Geographical Society. Price £2, 2s. net, bound in cloth, or £2, 12s. 6d. in half-morocco. *John Bartholomew and Co., Edinburgh.*

This atlas is noticed elsewhere (p. 381).

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

# A GEOGRAPHICAL DESCRIPTION OF THE COUNTY OF AYR.[1]

By T. M. Steven.

(*With Map.*)

*Geological Structure.*—For illustrating those principles which underlie modern conceptions of geography, the county of Ayr possesses many advantages. Its general position and place relations provide an excellent commentary on the change of geographical values in modern times; its boundary and lines of communication are of quite typical nature, and their effect may be traced in national as well as in local history: while its interests and resources are so varied and so well balanced that most types of Scottish scenery and industry find their counterpart, even if only in miniature, within the narrow limits of a single shire.

Variety, indeed, is the most characteristic feature of the Ayrshire of to-day: the pursuits of agriculture, shipping, mining, and industry which mark various stages in its economic development have been preserved side by side, partly by a kind of industrial inertia, but still more by the persistence of favourable conditions. And through all the variety runs a strange balance, so that no one interest wholly commands the prosperity of the county. Underlying the variety, and determining the balance, there is the far-reaching effect of geological structure. This it is which acts alike in scenery and agriculture and industry, binding all into a coherent and geographical unity: and with this a geographical description may most naturally begin.

[1] This essay was awarded the silver medal offered by the Society for competition in the Geography Class at Edinburgh University during 1911.

The greater part of Ayrshire lies in what is known as the Midland Valley of Scotland. This is a true rift valley, which formed an area of subsidence in Old Red Sandstone times, and in which younger formations have been preserved. No trace, indeed, can be found of Mesozoic or Tertiary rocks: but the Lower Old Red, Upper Old Red, and Carboniferous systems are represented, while in Ayrshire there remains a small basin of Permian age.

Denudation is mainly responsible for the present exposures of these formations, and has conferred on them no small degree of symmetry. Thus the great boundary faults which bring them down against the older rocks of the Highlands and the Southern Uplands run across the country from south-west to north-east. Lining each fault is a belt of rocks of Old Red Sandstone age: and between these belts lies the Carboniferous system of Scotland. The coal measures, one of the youngest members of the Carboniferous group, appear towards the centre of the valley. Even there, however, they have yielded to the agents of denudation, and in places older rocks have been exposed. Thus the coal-fields of Scotland occupy little basins to some extent protected by a hard rim of older igneous material which passes from the long line of the Sidlaws, Ochils, and Campsies into the Kilbirnie Hills between Ayrshire and Renfrewshire, turning then south-eastward to form a high moorland tract between the Clyde and its firth.

It is in the light of this more general distribution that the geology of Ayrshire is most easily and most profitably read. The southern fault of the great rift valley runs from Girvan on the coast to New Cumnock on the inland boundary of the county. South of this line the rocks are Silurian. The two divisions of the Old Red Sandstone age are both represented; in the south by a stretch of country from Girvan to the Heads of Ayr and from New Cumnock to Darvel, in the north by a fringe of coast from Wemyss Bay to Ardrossan. These are overlain, however, in places by the Carboniferous series, which isolates geologically the district round Maybole from that round Lanark and the northern fringe from the main Old Red belt. The little Permian basin lies unconformably over this at Mauchline, about the middle of the county, and is protected by a rim of igneous rock of the same age. Round this appear in order the various members of the Carboniferous group, the limestone series being extensively developed in the north of the county. The outermost layer is represented in the north and east boundaries by igneous rocks of Calciferous Sandstone age: and beyond this rim the reverse order is followed into the coal-basin of Lanarkshire.

*Scenery.*—Denudation has had a physical as well as a geological effect on the county. The hard Silurian and igneous rocks have been carved, indeed, but roughly and unsteadily, while the softer beds of the coal-measures have been planed down with merciless severity. The sea, too, has sought out the weakness that was opposed to it: for the waves that beat in vain upon the sandstone cliffs of the north, or lose their energy in hollowing out the coves and crannies round Ballantrae, have eaten into the heart of Ayrshire to form the wide, sweeping bays of Irvine and Ayr, giving, together with the

circular trend of the inland watershed, its characteristic crescent form to the county. In the inside of this crescent lies the lower ground of Ayrshire, sloping gently to the south-west from the limestones of Kilbirnie and Beith, and stretching southward in long undulations over the coal-measures from Kilmarnock and Kilwinning to Cumnock and the Heads of Ayr, the regular outlines broken only where some isolated neck of igneous material forms a local eminence. Round this, like a skin, clings an almost continuous belt of higher ground. Scarcely reaching 1000 feet above sea-level in the bleak moors of the north-east, but more rugged in the Old Red Sandstones on either side of Muirkirk, it rises in the Silurian rocks till an almost uniform height of 2500 feet is maintained along part of the south-eastern boundary. In this southern district the only lowland strips are along the river valleys, where the Doon, the Girvan, the Stinchar, and the Dusk wind among the fertile haughs of alluvium they have themselves laid down.

From such a point as the old Roman camp crowning the volcanic neck above Dundonald, much of this surface lies expanded to the view: for the county is nowhere broader than 26 miles, or longer than 55, though the coastline with its points and bays extends to 84. Away in the north can be seen the curious terraced outlines of the hills above Largs. Harmonising with the rounded form of the Great and Little Cumbraes in the Firth of Clyde, they rise in a series of humps to the north-east, and mark successive eruptions of volcanic material. Eastward, crowning the long, straight valley of the Irvine, rises the historic cone of Loudoun Hill, in form and isolation balancing the mighty mass of Ailsa Craig which lies far out in the Firth. On either hand rolls the fertile lowland, its little crests adorned with clumps of trees—a landscape monotonous to some minds, but with an air of comfort and prosperity born of the sweeping fields of green pasture or ripening grain, and of the distant wisps of smoke that betoken towns and industry. Southward the gentle folds rise slowly to the sandstone hills above Maybole, over which, rugged and more abrupt, peeps line upon line of the Southern Uplands.

The scenery of the coast does but present, as it were, the interior in section. The hilly ground descends to the shore in steep bluffs, as on either side of Largs; the igneous rocks break out in towering cliffs at the Heads of Ayr and Culzean Bay, or in a picturesque confusion of points and coves round Ballantrae, or jut out to break the featureless regularity of the bays, like the curving promontory in whose shelter lies the harbour of Troon. But a new effect has been introduced by what is geologically a comparatively recent upheaval of the land, when the plain of marine denudation, carved out and levelled under the waves in the dim past, was slowly uplifted to a height of about 25 feet. Other terraces or raised beaches of this kind may, indeed, be traced in various parts of the county, but to none of them is a like economic importance attached; for on this strip are built the coastal towns of Ayrshire with their numerous interests and activities, and along this strip lies a remarkable line of transport and communication. Extending to a breadth of two miles over the softer strata between Irvine and

Troon, and narrowing in the north and the south, where a few yards had been laboriously gained by the ceaseless fretting of the waves; concealed and made irregular by the great accumulations of blown sand at Turnberry and in the bays of Irvine and Ayr; interrupted in places by the great intrusions of Bennane Head and the cliffs south of Ballantrae, this strip still forms an essential and characteristic feature of the scenery. The road along this, which ranks with the river-valleys as a line of communication of the first importance, curves inland to avoid the obstacles, or rises to surmount them; and at its side rise the steep bluffs of the old sea-front, beyond which is a perfect switchback of undulations.

The Ice Age represents one of the latest of the great agents affecting the scenery of our country; but while its effects can easily be traced in Ayrshire, they have been felt rather in its agriculture than in its scenery. The grooves found on exposed rocks in the northern part of the county, together with the distribution of erratic boulders, show that a mass of ice descended from the Highlands; like evidence in the south indicates that another sheet pressed northwards from what has been called the Great Galloway Cauldron, hollowing out the basin of Loch Doon, and meeting the southward drift about the middle of the county, where both turned west into the Firth of Clyde. Besides the erratic blocks, which are most in evidence along the valley of the Girvan, and even over the neighbouring hills, this movement deposited a uniform coating of boulder clay or till which served to conceal any ruggedness the low grounds may have possessed. Following the general undulations of the surface, this till held within its folds (being of a stiff nature, retentive of moisture) many lochs and marshes. Some of these, like Kilbirnie Loch in the north, still exist; but most have been drained, giving rise in some places to peaty mosses, and in others to alluvial meadows of great fertility. Isolated examples of other remains left by the Ice Age may be found, like the kames of sand and gravel at Ochiltree and in Glen Afton, but they are so scanty as to be rather of geological interest than of geographical importance.

While the eastern rim of high ground naturally forms the main watershed of the county, there are some points of minor interest that deserve attention. The drainage of Ayrshire is carried out for the most part by six streams—the Garnock, Irvine, Ayr, Doon, Girvan, and Stinchar—all rising in the high ground near the boundary, and none navigable, so short is the distance between hills and sea. The Garnock rises near Hill of Staik, on the northern boundary, and takes a direction roughly southward, joining at its mouth the Irvine, which rises near Loudoun Hill and flows almost due west. The area between these hills slopes to the south-west, and all the streams follow this direction, reaching one or other of the two main arteries. The Kilbirnie Hills form a water-parting of minor importance, sending the drainage eastwards to feed the Garnock, and westwards in short torrential streams to the Firth of Clyde.

Rising near the county boundary at Glenbuck, the Ayr pursues a westerly course, separated from the Irvine valley by a belt of high

ground, which extends even into the plains. This ridge, which stretches in a rough semi-circle from Mauchline to Tarbolton on both sides of the river, is due to a rim of igneous rock surrounding and protecting the pear-shaped basin of Permian sandstone: and it is noteworthy that the Ayr is not deflected from its course by so formidable an obstacle, but cuts its way through it in a series of ravines.

The Doon takes its rise in Loch Doon, through which passes the southern boundary, and flows north-west, reaching the firth just south of Ayr; while the Girvan, after flowing as if to join the Doon, turns sharply to the south-west, and keeps parallel to the more southerly Stinchar till the sea is reached. The high grounds rising above Maybole to Brown Carrick Hill send their waters to the Doon and the Girvan on one side, and on the other, as short hill-streams or burns, to the firth.

The courses of all these streams show little connection with the present geological structure. They wind over all formations and faults with equal indifference, the long straight valley of Glen App, in the extreme south, being the only case where the line of a fault is followed for any length. All indications point to the fact that the drainage system had been determined before the present formations were laid bare, the rivers having simply preserved their old beds by eating down into whatever strata were exposed. The most striking instance is afforded by the Nith, which, rising above Dalmellington, and starting to flow north like the Doon, suddenly sweeps round to the east and carries the waters of Glen Afton with it into Dumfriesshire. This indifference of the rivers to underlying structure imparts a pleasing variety to the scenery of the county; for the picturesque ravines of the Ayr and the Doon contrast pleasantly with the peaty headstreams of the northern rivers, or the fertile haughs and alluvial terraces which line their lower reaches.

*The Geographical Individuality of Ayrshire.*—After this glimpse of the structure and the physical features of Ayrshire, it will be interesting to trace the changes in administration which the district has undergone—the evolution, in fact, of the present county—bringing into still stronger relief its geographical individuality.

In early times the larger physical features of Scotland formed the most obvious racial partings. Prior to the opening of the historical record a Brythonic people seems to have driven a wedge through the Southern Uplands and to have established itself in the midland valley. The advent of new invaders—Vikings, Scots, and Angles—destroyed the simplicity of this distribution, the Highland Picts being driven to the south and east, and the Brythons forced westward to the Clyde and its firth. It was not, however, till these elements were welded into a single kingdom in the eleventh century that any systematic or definitive sub-division of the country took place.

This mediaeval or feudal division, accomplished by the rise of a central power and the introduction of Saxon and Norman barons, was one of convenience rather than necessity, of administration rather than opposition, but the comparative weakness of the Crown and the prevalence of feuds preserved the dependence of geographical on strategical

values. In hilly districts, where the only fertile land skirts the river-banks, population concentrates on the streams, and the people on either side are united by common interests and a common sympathy. Thus in such districts the mediaeval divisions grouped themselves round the valleys—Clydesdale, Nithsdale, and a host of dales in the border country. But in the plains, unnavigable rivers caused the only natural separation of the people, and in the days when bridges were few, formed barriers of great efficiency. Thus, while the eastern shores of the Firth of Clyde were cut off naturally from various inland dales and divisions by a rough semi-circle of high ground, more local districts were marked off by the Irvine, the Ayr, and the Doon. From the Irvine to the northern watershed stretched the rich lands of Cunningham, ruled over by the Cunningham family, whose head was Earl of Glencairn. Between the Irvine and the Doon, opening out to the inland ridge, lay Kyle, divided by the river Ayr into Kyle Stewart in the north, and Kyle Regis or King's Kyle in the south. Wedged between the Doon and the Firth of Clyde, and bordering on Galloway in the south was Carrick, the home of the Kennedies. Well may these old names be remembered, for they have been writ large in the history of Scotland. The Bruces were Earls of Carrick, and their title is borne to-day by the Prince of Wales. Kyle gave us the Stewarts, and Dundonald was the royal residence. From Rowallan in Cunningham came the mother of the Stewart kings; and the name of Glencairn is linked with memorable incidents in our history and our literature.

The separation of Carrick from Galloway in 1186 A.D. and its union in 1221 with the two more northerly divisions to form a single shire are facts admitting also of a geographical explanation. A division into highland and lowland, the probable result of racial antagonism between Strathclyde Brythons and Galloway Picts, became in more settled times unnatural and inconvenient, because indefinite. The hills project into the plains, and the lowlands invade the hills in long valleys. Under mediaeval conditions the most natural and most efficient separation of the people was effected by watercourses and watersheds, by the crest of the hills rather than their verge. Thus Kyle finds a suitable southern limit in the river Doon, and Galloway its northern limit on the divide of the Southern Uplands. The region between these, with plains in the north and hills rising in the south, formed a typical feudal division. It would find closest connection with the plains; so that when the central power was consolidated and the mediaeval bailiwicks were replaced by larger shires, Carrick was classed for purposes of administration with its northern neighbours.

With the building of bridges, the increase of intercommunication, and in these latter days the advent of the railway, the internal barriers have lost even the semblance of their old effect. The hereditary bailiaries of Cunningham, Kyle, and Carrick, for which local rivalry was so keen, are things of the past: the sheriffdom has been deprived of its heredity, and Ayrshire has been knit up in reality as well as in name into a distinct individuality. The strip of coastline which it occupies is quite unique and well defined. From Kelly Burn and Wemyss Bay in the

north, where the river Clyde may be said to end and its firth to open out, it stretches southward to Loch Ryan, where the Firth of Clyde is left behind and the long Atlantic swell breaks upon the shore. Passing over the Water of App which, like the Girvan and the Stinchar, has cut out a fertile valley among the hills, and is avoided by boundaries, the county comes to an end where Galloway Burn foams down the bottom of a wooded ravine. South of this the country looks to Stranraer, which is inseparably linked with the southern shores and the southern towns. The valleys of Wigtown and Kirkcudbright run northward to a point, those of Carrick southward. The true separation of the people —an uninhabited and almost pathless region—extends over some miles: so that for the sake of convenience and definiteness, the actual boundary line is often made to follow the course of mountain streams. In its main features the inland part of the present boundary shows great simplicity and may be characterised briefly. Its general direction is almost everywhere clearly marked out by a line of relatively great height: its actual course is often modified where definiteness can be gained: in the north between Lugton and Beith, where the hills break down, streams and lochs are employed to preserve the general direction.

*Communications and Place Relations.*—It was only a question of time till Ayrshire, as at present defined, should be adopted as an administrative unit. Its name was scarcely less inevitable, so outstanding was the geographical and historical importance of the town of Ayr in early times. This importance was the joint outcome of the position of Ayr and of the main lines of external communication, that is to say, of the places where the natural boundary of the shire is cut through or interrupted.

Reference to the physical map will illustrate this. In the north of the county is the great gap between the Kilbirnie Hills and Fenwick Moss, leading to Glasgow and the lower reaches of the Clyde. Then at almost regular intervals come lines along the valleys of the rivers Irvine, Ayr, Nith, Doon, and Dusk. The watershed being so near the coast and semi-circular in shape, all the streams converge in their lower reaches, their heads eating back into the hills, while the Nith has actually cut its way through, and descends into Dumfriesshire. Owing to the crescent shape of Ayrshire, the county town, lying midway on the coast and connecting the two banks of the river Ayr, is in such a position that lines radiating to Beith, Loudoun Hill, Muirkirk, Cumnock, Dalmellington, and Stranraer strike the boundary almost at right angles: the passes, in fact, all point like the necks of so many funnels down to Ayr. The river, presenting advantages for a harbour, adds to the importance of its town, while the existence of a bridge in early times, replacing a still older ford, brought the two banks into touch: the presence of Ayr, indeed, formed a strong link connecting the two divisions of Kyle.

A few points may be noted from history to illustrate the importance of these lines of communication. The broad northern gap was probably earliest in evidence, connecting this district with the rest of the kingdom

of Strathclyde, in particular with its capital Alcluyd or Dumbarton. The remains of Roman roads can be traced in the direction of Ayr from Dalmellington and from Loudoun Hill, where there was a camp. In mediaeval times, the line of most importance was that cut by the Ayr at Muirkirk and leading to Lanark, for a time the seat of government, and long one of the most important towns of Scotland. The Nith valley has risen in significance since Scotland and England became amicably united. It forms the only easy pass of international importance from Ayrshire, and is followed by the Glasgow and South-Western Railway, on its way to Carlisle and London. In modern times the extraordinary advance of Glasgow has transferred the bulk of the traffic once more to the great northern gap, the widest and best of all. This gap has been connected with the Nith valley to form a great north and south route, and the real importance of the county has been transferred to Kilmarnock, where this route cuts across the rich valley of the Irvine.

Thus at different times and under different conditions have the various lines of external communication proved their efficacy; internally the county is intersected by a network of roads, save in the higher grounds of the south and east, where the river valleys offer the only practical means of transport.

If the place relations of Ayrshire be considered more generally—its position in the commerce and history, not only of Scotland, but of the British Isles—a curious resemblance can be traced to the corresponding European relations of Britain itself. In early times, when the eyes of Europe were turned eastwards for civilisation and for commerce, when the trade routes, along which the course of history and development lies, were concentrated in or round the Mediterranean, Britain lay on the western verge of the known world. So also Ayrshire, the last considerable strip of any fertility in the west of Britain, stretched its arms towards the long Atlantic swell, while the obvious lines of early intercourse lay on the east, all round the narrow seas. We learn from Fynes Moryson, who wrote in 1598, that Scottish trade was mainly directed to four places—England, the Baltic, Bordeaux in France and Campvere in Zeeland—and there can be little doubt that Campvere or Veere was the great seat of the Scottish staple. For none of these places but Bordeaux did its situation give Ayrshire any advantages or even equality of conditions, the west coast of England having little wealth or prosperity till the rise of modern industry. The early trade of our county, in fact, was carried on chiefly with Ireland and the Scottish Isles, while the extensive smuggling engaged in later did not involve any greater voyage than to the entrepôt of the Isle of Man.

That a considerable local or coasting trade should arise in Ayrshire was to be expected. The great basin of the Firth of Clyde offers safety from every wind that blows, dotted as it is with natural havens—Belfast Lough in the south-west and Loch Ryan in the south-east, Campbeltown Loch in the west, and the bays of Irvine and Ayr in the east, and in the north, behind Bute and the Cumbraes, that almost land-locked stretch where the "Skelmorlie measured mile" is now used to test the speed of

vessels. The magnificent aspect of Bute and Arran and Kintyre urged the sailor to begin, and the security of the bays and sounds of the firth encouraged him to continue this local trade. But there was little incentive to extend it. Northward through the channel stretched the great unknown of the Atlantic. In the south stood the Isle of Man, as if to arrest progress. And since with England hostile he could never hope to reach the great centre of Scottish staple with any degree of security, the Ayrshire sailor at this time remained for the most part in his native waters and concentrated his attention on Ireland. This intimate connection between Ireland and Ayrshire is interesting on account of its continuity. It appears in the migrations of the early races of our island. Commercial relations were increased and rendered more stable by the colonisation of Ulster from south-west Scotland shortly after 1600 A.D. In more recent times, but before the modern development of agricultural implements, great bands of Irishmen landed annually to take part in the Ayrshire harvest: and the practice is not yet unknown. So steady, indeed, has been the flow of intercourse that Ailsa Craig—that huge dome off the Ayrshire coast—has earned for itself locally the significant name of "Paddy's Milestone."

When the discovery of a sea-way to India and the development of America gave a new European and world significance to Britain, Ayrshire gained not only directly from its position on the west coast with double approach from the Atlantic, but also indirectly from the rise of Glasgow on the one great river of the West of Scotland. The first effect was to open a new vista of prosperity to the ports of Ayrshire, though the great concentration of commerce higher up the Clyde eventually deprived them of pretensions to any but a local significance. So close, however, is the internal connection with Glasgow that this concentration has in the long run fostered rather than injured the industry and general prosperity of the county.

*Agriculture.*—Great as has been the effect of these place relations on the development of Ayrshire, the real cause of its prosperity must be sought in the resources—agricultural, mineral, and industrial—of the county itself. Agriculture, as it was the earliest, remained till comparatively modern times the most potent of these factors. In the days before farming was raised to the rank of a science, the natural characteristics of this part of the country were hit off in the old rhyme :—

> "Kyle for a man : Carrick for a coo :
> Cunningham for butter and cheese ;
> And Galloway for 'oo."

It is interesting to note the bearing of etymology on this matter. Thus Cunningham is with most plausibility derived from the Gaelic "cuinneag," a milk-pail ; Carrick probably owes its name to the word "carraig," which signifies a rock ; while Kyle, the place where Coilus, King of the Brythons, met his death, can testify in many local names as well as in this general one to the turbulent nature of its early inhabitants.

The character of the agriculture of the district is largely deter-

mined by its position, climate, and soil, and by a consideration of these we may briefly test the truth of the local rhyme.

Lying wholly between the parallels of 55° and 56°, the county is so far north that wheat cannot be grown on a large scale with any conspicuous degree of success, whereas oats are favoured by this position as well as by the character of the soil. The Scottish restriction of the word corn, which has so general an application in England, to the single crop of oats is not without its significance. While the effect of latitude is thus to determine the balance of the corn crops, the distribution of permanent pasture and cultivable land depends largely on altitude. Thus permanent pasture occupies a large part of Carrick and extends along the high ground of the county borders, while the crop lands of the south are practically confined to river valleys.

Ayrshire is favoured with an equable and moist climate. The prevailing winds from the west and south-west sweep in from the Atlantic, keeping the summer cool and the winter warm; and the moisture which they have gathered is deposited over the hills as rain or is condensed by the cold clay soil into a clinging morning mist. The rainfall, however, is nowhere excessive, and in the lower part of the county is less than anywhere else on the west coast of Scotland. This is due partly to the fact that the hills behind Ayrshire are generally of no great height, but mainly to the sheltering influence of Kintyre and Arran and the north of Ireland, which receive much of the moisture before the wet south-westers can reach the Ayrshire coast. Such a climate as this, where the annual rainfall nowhere exceeds 60 inches and is less than 40 inches over a wide tract, and where a general south-westerly or westerly exposure tends to draw the greatest possible benefit from the sunshine, favours the growth of many crops—especially root-crops—on suitable soils.

It is largely a broad difference in the character of the soil, as well as in altitude, that justifies so general a classification as is given in the traditional rhyme. Much of the shire is covered by a coating of glacial drift derived from north and south, but though erratic blocks can sometimes be traced to a distant source, the character of the boulder clay seems to follow in quite a remarkable manner the formations immediately underlying. There can be little doubt that the close of the Ice Age in Scotland was marked by a number of small glaciers, so that the present drift deposits are mainly of local origin, and the general character of the soil can safely be inferred from the solid geology of the district. At the same time, we must bear in mind that the boulder clay or till tends to be stiff and retentive of moisture, favouring the existence of marshes and mosses, investing with great difficulties the processes of ploughing and harrowing, offering a stubborn resistance to the roots of crops, and here and there giving rise to a soil so strong as almost to defy cultivation.

The effect of this clay was seen at its worst in Kyle. Here the presence of the coal measures with their associated formations offered few fertilising ingredients, and gave rise to a bluish-black soil of the poorest quality. Even the addition of limestone from the north and east, or Silurian drift from the south, failed to produce a soil capable of

yielding a secure living under the rude agricultural methods of early times; so that Kyle became known rather for the bold and troublesome nature of its men than for any natural product it could offer.

The limestone, on the other hand, which occurs on the northern fringe of the Carboniferous system, providing one of the most fertile and necessary ingredients of the soil, made the rich, sweet pastures of Cunningham early famous for dairy produce. Dunlop and its neighbourhood were especially noted, and this village has given its name to a particular kind of cheese. The trap-rock or basaltic rock that lines the north-east of the county, while forming a bleak enough region at that height and with that humidity, really contains the basis of a good soil, and, when spread over the lower grounds by glacial agency, added to the fertility of Cunningham and helped in the amelioration of Kyle.

The Old Red Sandstone of the north of Carrick lends itself to the formation of a rich soil, and the Silurian strata are fertile enough at a low level. But the general height of the district has caused much of the land to be left in pasture, when it supports an excellent breed of cows on the lower stretches, the upper moors, like those of Galloway, being the home of black-faced sheep.

This explains in a rough and general manner the facts stated so pointedly in the old rhyme. And from casual remarks of early Scottish historians and of foreigners who visited the country from time to time, as well as from the more detailed descriptions of local topographers, we know that these conditions held throughout the Middle Ages. It was only, indeed, during the latter half of the eighteenth century that any change was even attempted, for Colonel Fullarton, in his report to the Board of Agriculture in 1793, drew a very black picture of the condition of Ayrshire some forty years previously. This period, however, was the turning-point in the history of our agriculture. The era of experimental and scientific farming was being ushered in.

The more outstanding improvements of agricultural methods in modern times are connected with drainage, manuring, and rotation of crops. The stiff retentive clay which covers a great part of Ayrshire led to the existence in early times of extensive marshes and mosses, traces of which still remain. But when enterprise had levelled the old forests, and intelligence had drained not only the marshes but the soil itself, it was found that this clay in reality contained many ingredients of fertility, gained doubtless from the trap-rocks and limestones of the north and east. The application of lime, which could be obtained and burnt locally, and of the variety of manures provided by modern science, has converted the once ungrateful clay into a soil on which good farming can achieve wonderful results. Oats, rye-grass, and timothy, are most successfully grown on this clay soil, root crops being avoided. The continuous growth of corn crops, however, soon led to the impoverishment of the land, until a system of rotation was introduced. Each district, each type of soil, demands its own special rotation, one of seven years' duration being most favoured in the cold stiff clay of north Ayrshire—two of oats, two of hay (rye-grass followed by timothy), and three of pasture. Farther south, as the soil becomes lighter over the sandstone formations,

green crops are grown not only with safety but with profit, and a different system of rotation is accordingly adopted. An extreme instance presents itself in the truly remarkable farms on the coast near Girvan, almost entirely devoted to early potatoes. These are grown with astounding success on loose sandy ground altogether worthless for other crops, and no rotation at all is followed, the strength of the soil being maintained by great loads of manure.

The basis of all farming in the north of Ayrshire is still dairying, whether for the distribution of milk in local centres and in Glasgow or for the making of butter and cheese. Cunningham, indeed, sustains its old reputation, for the West of Scotland dairy school has been placed at Kilmarnock, and the annual cheese show here is the most important in the kingdom. The dairy stock consists largely of the famous Ayrshire cows, much esteemed for both the quantity and the quality of their milk. Carrick is still famous for its cows of the Galloway or the Shorthorn type, and for its horse-breeding too: while bleak hills and moors all round the county, especially in the south, support great flocks of black-faced sheep that recall the fame of Galloway. Kyle alone has been changed out of all recognition.

Many of the Ayrshire farms combine two or more of these branches, so near are the hills to the plain, the plain to the sea, and so rapidly does the nature of the soil vary: but the basis of farming in each district follows the general lines indicated. Variety, indeed, is characteristic of the agriculture of the county, as of its other interests. And the unqualified success of each type gives evidence of good and intelligent working, so that farmers from this district have found little difficulty in dealing with land in Essex, Canada, or New Zealand. A soil rich enough to repay industry, yet poor enough to stimulate energy and intelligence, has played no small part in building the character of rustic Ayrshire. (For statistics, see end of paper.)

*Mineral Wealth.*—Till comparatively modern times the economic value of Ayrshire continued to depend on the soil-producing qualities of its rocks. By the recognition and development of its mineral resources, however, and the consequent accumulation of industry, a great transformation has been wrought, and the balance of prosperity within the shire has been considerably altered.

The mineral wealth is by no means equally distributed. Igneous rocks, indeed, which are in great demand as road-metal, come to the surface at points all over the county: but only such an exceptional quarry as that of whinstone at Dundonald Hill is of more than local significance. Building stones are well distributed: but they, too, are quarried chiefly for local use, though the bright red sandstones of Mauchline are sent far afield. In richness of appearance and in ease of working the Mauchline freestone stands in a class by itself; and for this exception the county is indebted to that basin of Permian age which has been noted as occupying a distinctive place in the geology and scenery of Ayrshire. For rougher and less ornamental purposes other quarries are in use locally, the best-known lying for the most part on an undulating line from Prestwick through Symington, Dundonald,

Dreghorn, Ardeer, Kilwinning, and Dalry to Kilbirnie and Beith. It will be observed that this line winds through the heart of the carboniferous region: indeed it actually skirts some of the most important workable coal-seams, for the stone most favoured is drawn from the white and grey sandstones within which lie basins of the coal measures. Limestone is quarried to some extent for building purposes, and still more for use in agriculture and in the working of iron-ores.

While these examples serve to show in some degree the great advantage possessed by the carboniferous strata, their effect is insignificant compared with that of the economic deposits of coal and iron. While the output of iron-ore is now greater in Ayrshire than in any other county of Scotland, the coal-basin generally is not so rich as that of Lanark. An explanation of this may be found in the distribution of workable coal-seams in the county. The great division is effected by that pear-shaped basin of Permian sandstone which has been forcing itself on us as a feature of primary importance in the geography of Ayrshire. Round this nucleus, with its protecting rim of igneous rock, lies a belt of Upper Red Sandstone—the youngest formation of the Carboniferous group—and it is beyond this that the actual coal-measures crop out at the surface, wedged in for the most part by limestones and calciferous sandstones. We may almost detect in fancy the original pear-like shape of the nucleus preserved roughly in these outer layers: the broad head being defined by an almost continuous series of coal-beds through Dalmellington, Cumnock, and Muirkirk: one side passing down the long straight valley of the Irvine by Newmilns and Kilmarnock to meet at Kilwinning the other, which has followed the coast northward by Coylton, Annbank, and Irvine; and from the tapering point, if we may so far press the analogy, a little stalk curves inwards by Dalry and Kilbirnie. Indications of the presence of coal have been found on the northern edge of the nucleus at Tarbolton, Craigie, and the Cessnock, but generally at too great a depth to allow their working: so that the preservation of this area, while imparting a pleasing variety to the scenery and providing building-material for half the countryside, has in all probability limited the wealth of Ayrshire by concealing under its strata the rich seams of coal and iron.

Besides the iron-ores at Dalmellington, Muirkirk, and Dalry, of which the blackband is supposed to contain almost enough carbonaceous matter to carry out its own smelting, beds of clay are associated with the coal-seams; and these are of economic importance in the neighbourhood of Kilmarnock and Kilwinning for the manufacture of bricks and sanitary ware. Local divisions between the various coal and iron beds are formed partly by faults and partly by igneous intrusions in the form of dykes, sills (or whin-floats, as the miners call them), and necks. These often destroy coal-seams through which they pass, and may occasionally be traced at the surface, the dykes appearing as ridges of greener turf, and the necks earning by the fertility of their trap soil the significant name of "Greenhills." Rarer minerals like the lead and antimony of New Cumnock, the copper of Dalleagles, the agates turned up by the plough at Galston, or the thin vein of platinum exposed on the rocky

shore at Dunure, occur in such small quantities as to be rather interesting curiosities than of any present economic value. The granite, indeed, of Ailsa Craig is being quarried for the manufacture of curling-stones, for which it has proved superior to all other rocks; and serpentine, found at Lendalfoot between Girvan and Ballantrae, may yet be used for ornamental purposes. But the real wealth of Ayrshire lies in the less pretentious minerals and in the host of industries that have gathered inevitably along the lines of their development.

*Industries.*—In origin and to some extent in distribution the present industries of the shire may be referred to the latter half of the eighteenth century. Prior to this, but for the isolated instance of the shoe and carpet manufactures of Kilmarnock, industries of any but purely local importance did not exist. For generations each farm or each hamlet had provided its own supply of flax and wool, to be spun by the women and fashioned into a coarse cloth. These crude methods of antiquity were at length superseded by the great movement known as the Industrial Revolution, when the extending range of commerce, the invention of machinery, and the development of minerals combined to change geographical values all the world over.

Ayrshire was peculiarly fitted to profit by the new conditions. The necessaries of life were there in abundance. Of fuel there was an almost unlimited supply, whether in the form of peat—then widely used by the people—or in the hitherto undeveloped fields of coal. Building material was scattered liberally over the county. Water-power for industry was at hand, and the raw material could easily be obtained. Alike by sea and by land were ready means of communication for receiving goods or for reaching wider markets. With all these advantages Ayrshire lay open to the new activities and the new interests. Capital alone was required for its full development.

Several events occurred about this time to provide the capital. The bank of Douglas, Heron and Co., established at Ayr in 1769, lent out money with reckless prodigality. The landowners, no less reckless and no less prodigal, mortgaged their property and used the capital to develop its resources. An incredibly short time saw the soil ameliorated, the landscape beautified, the roads improved, and the minerals opened up: and there rose an Ayrshire trim and prosperous like that which meets the eye to-day. But when the bank closed its doors in 1772, the mad speculation had involved half the countryside in its ruin. Estates changed hands: and into the county poured a new set of farmers with new ideas, new enthusiasm, and, above all, new capital.

Events of still wider significance were happening in the outside world. Glasgow had sprung from local to world-wide importance by the profits of its trade in sugar and tobacco. To purchase these cargoes from America and the West Indies, manufactures were set up in and round the city, and these flourished so rapidly under the stimulus of the new and lucrative commerce as to overflow into Renfrewshire and the north of Ayrshire. When the separation of the American colonies put an end to much of the former profit, and increased the former risk, Glasgow, with its ports of Greenock and Port-Glasgow, had already

reached industrial stability; so that many merchants forsook their former business and applied their wealth to the development and the creation of industries. Of this capital no small share found its way into Ayrshire, whose resources were already known. With abundance of fuel and of water-power, with low rents and cheap labour, rural districts were able to overcome the grave economic disadvantage of remoteness from the markets, a disadvantage which every invention in machinery, every improvement in transport—by road, horse-rail, or canal—served to lessen, till finally the locomotive and the steam-boat came, and the world shrank, leaving the industries of Ayrshire in a position of security.

The manufactures which were thus introduced into the county, and which took root there with varying degrees of success, were mainly connected with the fabrics of wool, linen, silk and cotton, also of leather and iron. Of these, traces of the first three are to be found in earlier days, the raw materials being at hand locally. The bonnets and carpets of Kilmarnock were already well known, and similar manufactures were established at various points, especially—as at Stewarton and Cumnock—near moorland districts with their large flocks of sheep. But, if we allow for the added impetus given by modern machinery, it is impossible to say that the woollen industry has thriven in the county. It has advanced, indeed, and still adds no paltry share to the wealth of Ayrshire, but it has not kept pace with the development of other and stronger interests. Linen, too, has suffered greatly in the race of industrial competition: and the mills at Beith and Barrmill—now entirely dependent on imported materials, though originally supported by local crops—serve only to illustrate the industrial inertia which has led to their preservation. The leather industry, which rose naturally enough in the centre of Carrick with its cows, still forms the staple trade of Maybole, and exists also in Beith and Kilmaurs, while the whirlpools of Kilmarnock and Ayr have sucked it in among their multitudinous activities.

Of the three remaining commodities, silk is now of least account in the prosperity of the shire. This industry spread from Paisley, and scarcely penetrated beyond the north of Ayrshire: here it still lingers at Beith, but in a state of decline rather than expansion. Cotton and iron, however, have taken firm root in the county, revolutionising its aspect, and almost crowding out the other industries. The cotton works are spread well over the district, but are seen to best advantage in the smaller towns, as at Catrine, at Patna, and along the Irvine valley in Galston, Newmilns, and Darvel. The development of the great coal and iron fields of Ayrshire has been the most potent factor in its transformation, gathering industries round the mining districts. The chief iron works are at Muirkirk, Dalmellington, Hurlford, Stevenston and Glengarnock: while Kilmarnock, from its central position in one of the richest and most extensive mineral basins of the county, has come to be a recognised home of iron industries, containing the chief works of the Glasgow and South-Western Railway, and reaching world-wide fame in engineering generally.

Besides these industries, introduced or developed at this time of

commercial awakening, others have sprung up more recently, but have almost invariably grouped themselves round the already active mining districts. Best known are the furniture works of Beith and the chemical works of Ardeer, Irvine, and Ayr. An interesting lesson may be drawn from the Nobel explosive works which occupy a long stretch of barren dunes extending from Stevenston to Irvine. In reality a miniature town, with three main stations and many branch lines on its own little railway, these great works presents little to the casual eye but a few chimney-stalks rising strangely enough from the sand: for the buildings straggle in and out among the dunes, each little magazine being isolated and protected by the enclosing sand, so that any explosion which may occur will not be propagated but will be smothered locally. With this useful application of the blown sand, together with the long series of famous golf-links covering the less barren dunes from Irvine to Ayr, and with the potato-growing of the Girvan coast, some of the once most worthless land in the county has been made to yield a more than satisfactory return. Even the Shewalton Moss between Irvine and Troon has been utilised for the production of moss-litter: but the moory uplands of the border still form a most efficient separation of Ayrshire from her neighbours.

*Distribution of Population.*—The distribution of the population and the changes in that distribution reflect, as it were, the general condition of the county, and present a concrete illustration of much that has already been said as to its prosperity and development. For our knowledge of the grouping of very early inhabitants we have to depend largely on the significance of place-names. The tumuli, crannogs, and other antiquities found at various parts of the county are of little assistance, for we know not how much may have been destroyed by the lapse of centuries: but a local name tends to cling to villages or natural objects through all the vicissitudes of fortune and of racial change. From authentic history we learn, as indeed we might be led to infer from the moors and mosses of Ayrshire, and from the great trunks found imbedded therein, that much of our county was covered in early times by extensive forests; and place-names in "dal" and "shaw," in "wood" and "hirst," show that these were still largely in existence when the Celtic tongue was being overthrown, and that many of our present towns and villages owe their origin, however humble, to this distant time when they served as centres of reclamation. But while there is food for the imagination in such a name as Tarbolton—an old haunt of the worshippers of Baal—where the Beltane fires have lingered with lost significance to modern times; or in such an old-world spot as Barr—nestling among the southern hills, oblivious of the revolutions of industry and ignored by the triumphant progress of the locomotive—where the traditions of Celtic Galloway clung with strange persistence, and while traces of Celt and Roman and Viking supply the half-guessed history of that remote time, this region of conjecture and conflicting opinions need only be mentioned here.

With the wholesale parcelling out of land to Saxon and Norman lords, by which Malcolm Canmore and his successors sought to cement their new-formed kingdom, and with the wave of religion which swept over the country under the "sair sanct" David I., baronial castles

sprang up all over the country, and ecclesiastical houses pushed forward a wedge of enlightenment and application. It was in the neighbourhood of these castles, for purposes of mutual support and protection, and under the guidance of these houses of religion, that the hamlets of feudal times gathered or flourished. The reality and the strength of baronial control may be gauged from the following rhyme quoted from tradition by Abercrummie in 1696 :—

"'Twixt Wigtoune and the town of Aire,
And laigh down by the Cruves of Cree,
You shall not get a lodging there,
Except you court a Kennedy!"

It is to the Kennedies, once supreme in this bailiwick, that Carrick owes the ruins which adorn its rocky coast and river valleys, which have earned for it the name of "Land of Castles." It was from the Kennedies, concentrating into the metropolis, that Maybole derived that "ancient splendour" which laid the foundation of its modern industrial prosperity. But it was more often by the houses of religion, the abbeys of Kilwinning and Crossraguel, the monasteries of Mauchline and Ayr, and their outlying chapels, with their steady and intelligent aim of improving the social condition and developing the resources of the shire, that the basis of prosperity was laid.

The displacement of old-world lethargy by modern industry and energy undoubtedly forms the most instructive period in the development of the population. Here figures are available, and will serve to indicate at a glance some interesting geographical lessons. (Table I.)

I. Population Table: Alphabetical order.

| Parish. | 1755. | 1801. | 1901. | Parish. | 1755. | 1801. | 1901. |
|---|---|---|---|---|---|---|---|
| Ardrossan | 1297 | 1846 | 11,845 | Kilmaurs | 1094 | 1288 | 4549 |
| Auchinleck | 887 | 1214 | 6,605 | Kilwinning | 2541 | 2700 | 8125 |
| Ayr | 2964 | 5492 | 31,537 | Kirkmichael | 710 | 1119 | 1798 |
| Ballantrae | 1049 | 837 | 1,124 | Kirkoswald | 1168 | 1679 | 1578 |
| Barr | 858 | 742 | 581 | Largs | 1164 | 1361 | 5501 |
| Beith | 2064 | 3103 | 7,523 | Loudon | 1494 | 2503 | 8205 |
| Colmonell | 1814 | 1306 | 1,954 | Mauchline | 1169 | 1746 | 2572 |
| Coylton | 527 | 848 | 2,542 | Maybole | 2058 | 3162 | 7889 |
| Craigie | 557 | 786 | 509 | Monkton | 582 | 986 | 3854 |
| Dailly | 839 | 1621 | 1,673 | Muirkirk | 745 | 2560 | 5670 |
| Dalmellington | 739 | 758 | 5,261 | New Cumnock | 1497 | 1112 | 5367 |
| Dalry | 1498 | 2321 | 8,212 | Ochiltree | 1210 | 1308 | 1932 |
| Dalrymple | 439 | 514 | 1,208 | Old Cumnock | 1336 | 1798 | 5144 |
| Dreghorn | 887 | 762 | 4,332 | Riccarton | 745 | 1364 | 8080 |
| Dundonald | 983 | 1240 | 11,250 | Sorn | 1494 | 2606 | 3607 |
| Dunlop | 796 | 808 | 1,542 | Stair | 369 | 663 | 1175 |
| Fenwick | 1113 | 1280 | 1,063 | Stevenston | 1412 | 2146 | 9487 |
| Galston | 1013 | 2139 | 6,979 | Stewarton | 2819 | 2657 | 3958 |
| Girvan | 1193 | 2260 | 4,872 | Straiton | 1123 | 1026 | 1016 |
| Irvine | 4025 | 4584 | 6,458 | Symington | 359 | 668 | 592 |
| Kilbirnie | 651 | 959 | 7,207 | Tarbolton | 1365 | 1766 | 3961 |
| Kilmarnock | 4403 | 8079 | 33,142 | West Kilbride | 885 | 795 | 2978 |

The first striking feature is the superiority in numbers which Kilmarnock possessed over Ayr in 1755. The early advantages which made Ayr the most natural county town have already been considered; but these largely ceased to be operative, or at least were profoundly modified, in the seventeenth and eighteenth centuries. Ayr has been essentially a strategical point, finding most intimate connection with the military period of history. Its occupation by Cromwell, in pursuance of a far-sighted scheme which secured also Dunbar, Burntisland, Leith, and Inverness, as the reins of Scotland, stamps the essential character of its importance. But with the final establishment of peaceful relations throughout Britain, such a town had an ever-diminishing rôle to play. The advantages of Kilmarnock, on the other hand, were progressive. Situated in the heart of a rich district, it became a centre of local trade, so that, as we learn from Timothy Pont, other towns of Cunningham might have an annual fair while Kilmarnock had one "every Saturday—a great market." Commanding not only an east and west route to the sea at Irvine or to Lanark and the Clyde, but the great north and south route from Glasgow to Dumfries and Carlisle, it was in a position to profit by the increase of traffic; and every industry found a ready welcome in a district so strong in natural resources. Ayr, in short, was of strategic and maritime importance, and flourished with Lanark. Kilmarnock was never of strategic, but early of industrial importance, and has risen with Glasgow.

Even in maritime affairs Ayr never held a supreme or unchallenged position. The table (II.) showing the development of the coastal towns reveals several matters that require some explanation. Irvine was raised to the rank of a royal burgh almost as soon as Ayr in the thirteenth century —a privilege which was not conferred on Kilmarnock, the only other example in the county, till 1672. With almost equal facilities for internal communication, Irvine possessed a better harbour; for Ayr has always been troubled by the silting of its river, which requires the constant attention of a powerful dredger at the present day. But proximity to Glasgow was the determining factor which had given the more northerly town its great lead by 1755. When navigation on the Clyde was prevented by a sill of rock rising as a barrier almost to the surface, and when the harbour at Port Glasgow had not yet been built, Irvine came to be used to some extent as the port of Glasgow, so that it was carried forward on the crest of the first wave of the industrial movement.

II. Royal Burghs and Coast Towns.

| Parish. | 1755. | 1801. | 1901. |
|---|---|---|---|
| Kilmarnock . . . . | 4403 | 8079 | 33,142 |
| Ayr . . . . . | 2964 | 5492 | 31,537 |
| Irvine . . . . | 4025 | 4584 | 6,458 |
| Ardrossan . . . . | 1297 | 1846 | 11,845 |
| Dundonald . . . . | 983 | 1240 | 11,250 |
| Girvan . . . . | 1193 | 2260 | 4,872 |
| Ballantrae . . . . | 1049 | 837 | 1,124 |

The lapse of a hundred years shows a great revival of Ayr and a relative decline of Irvine. The development of southern Kyle, as well as the establishment of industries in the immediate neighbourhood of the county town, has endowed Ayr with prosperity of a new and lasting kind. Its old rival had been dependent largely on its carrying trade for northern districts, and when shorn of this by the rise of local ports and by the extension of navigation in the upper reaches of the Clyde, it was left without real industrial activity, being largely supported at the present day by two chemical works.

Simultaneous with this decline, and to some extent explaining it, a great advance should be noted in the parishes of Ardrossan and Dundonald, the latter including the port of Troon. This forms one of the most interesting examples which the county can offer of the direct and discriminating influence of man on geographical values: for these harbours were not developed by the gradual sifting of the ages but were created by the geographical discernment and laudable enterprise of a few individuals to satisfy the growing needs of an industrial community. "The Troon," as it is called locally, indicates by its name (which means the promontory) an essential feature marking it as a haven. Jutting out from the sweeping bay of Irvine, this promontory curves slightly to the north and encloses a harbour sheltered from almost every wind. Ardrossan, too, is well protected from storms by the natural breakwater of Horse Island. The early rise, however, for purposes of strategy and communication, of towns at the river-mouths, their sufficiency for carrying on the commerce of the county, and the monopoly granted them later for that purpose, prevented the use of these more natural harbours. Recognised they had been, for to smugglers the Troon was well known for its safety and for the solitude of its long lines of bleak dunes: but it was left to the Duke of Portland to complete its efficiency and to connect it with the industrial centre of Kilmarnock by the first railroad in Scotland.

At Ardrossan the necessary improvements were carried out by the Earl of Eglinton, who conceived the idea of joining it to Glasgow by a canal. This canal was actually carried from Tradeston as far as Johnstone, but before it could be completed Ayrshire had ceased to be regarded as the natural outlet of Glasgow. These two ports, then, of Troon and Ardrossan have not followed the general lines along which the county has developed, but sprang into prominence when the time was ripe: and in their present state of modest prosperity they are likely to continue, exporting the coal and pig-iron which the county produces in such quantities, and importing chiefly iron-ore, limestone, and wood, on which so much activity has come to depend.

Of those ports which rose at the mouths of the two southern rivers, Ballantrae has clung to the declining industry of fishing, and so has remained stationary: Girvan, favoured by the railway, has taken to other industries, and has advanced accordingly.

For the rest, the population statistics may be left to explain themselves. It is interesting to compare the prosperity of Old and New Cumnock in 1755 with the condition of Dalmellington and Muirkirk. (Table III.)

The supremacy of the great north and south route over other lines of communication is clearly shown; while the rise of mining and industry in each parish accounts for the subsequent levelling of these differences. Districts dependent on pastoral and agricultural interests—Dunlop and Fenwick, Craigie and Symington, Straiton and Barr—left behind by industry and even in some cases by the railway—have made little or no progress. From the same humble beginnings places like Mauchline and Auchinleck have risen to industrial prosperity: and the distribution of population at the present day will be found to follow in quite a remarkable manner the outline of the coal-beds as previously traced.

### III. Towns at Passes.

| Parish. | 1755. | 1801. | 1901. |
|---|---|---|---|
| New Cumnock . . . | 1497 | 1112 | 5367 |
| Old Cumnock . . . | 1336 | 1798 | 5144 |
| Muirkirk . . . . | 745 | 2560 | 5670 |
| Dalmellington . . . | 739 | 758 | 5261 |

*Local Characteristics.*—The influence of geography on history may be said to be twofold. It acts directly by the economic and strategic values of barriers and lines of communication, and at the same time indirectly through the particular colouring which nature has bestowed upon the local outlook.

It has been seen that in Ayrshire the more material influence was at once obvious and effective. The local characteristics are no less clearly expressed in our national history and literature. The associations of Ayrshire with the exploits of Wallace and Bruce and with the less Homeric but more fervid episodes of covenanting times are well known; and it was in the hills and moors of the county that a spirit of liberty and tenacity was fostered.

Local rhymes and traditions have been called popular landmarks in statistics. The poems and songs of a people may with equal truth be taken as storehouses of character. And though the rapidity and extent of modern intercourse has tended to destroy or modify local individualism, Ayrshire is fortunate in having had its Burns, its great observant and responsive genius, sent at a critical period in its history. In his pages are portrayed in bold and faithful outlines those elements which largely constitute the Ayrshire of to-day; and inasmuch as such a man has noted and preserved them, their geographical effect has been increased. All the sentiment clinging to a bygone age, all the conviviality of the new, the slow strength of the old life and character, the brilliance and intelligence of the new, find in him a permanent expression. And through it all runs a vein of kindly humour and a quiet colouring that are characteristically local. It was nature on the small scale that Burns knew—the banks and braes of the Ayr, the Doon, and the Afton in all their moods and seasons—and it was her details that he

loved: and the great message which Ayrshire has given to the world, summing up its geographical and historical influences, is one not of spacious theory, but of strong concrete practical sympathy—the creed of "Nature's social union" and the brotherhood of man.

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APPENDIX.—The acreage under the chief crops, the yield per acre, and the number of live stock, are shown in the following table, where Ayr is contrasted with Argyll and Edinburgh.

## IV. AGRICULTURAL STATISTICS.

### Acreage under Crops (1909).

| County. | Total Acreage under Crops. | Arable Land. | Permanent Grass. | Wheat. | Barley. | Oats. | Potatoes. | Grasses in Rotation. |
|---|---|---|---|---|---|---|---|---|
| Ayr, . . | 318,675 | 158,005 | 160,670 | 902 | 821 | 42,236 | 9358 | 94,646 |
| Argyll, . . | 131,765 | 54,023 | 77,742 | 1 | 1441 | 16,692 | 3938 | 24,992 |
| Edinburgh, . | 126,763 | 81,082 | 45,681 | 5832 | 4882 | 20,518 | 7120 | 29,961 |

* *Exclusive of mountain and heath.*

### Average Yield per Acre (1898-1907).

| County. | Wheat (bush.) | Barley (bush.) | Oats (bush.) | Potatoes (tons). | Grasses (cwt.) | Permanent Pasture (cwt.) |
|---|---|---|---|---|---|---|
| Ayr, . . | 41·52 | 39·59 | 46·27 | 7·59 | 34·33 | 40·61 |
| Argyll, . . | — | 31·34 | 31·34 | 4·87 | 29·91 | 29·96 |
| Edinburgh, . | 46·01 | 44·03 | 42·48 | 7·56 | 59·26 | 33·49 |

*Only chief crops given in each table.*

### Number of Live Stock.

| County. | Horses. | Cattle. | Sheep. | Pigs. |
|---|---|---|---|---|
| Ayr, . . | 9755 | 101,974 | 371,515 | 12,888 |
| Argyll, . . | 6335 | 57,098 | 836,337 | 4,479 |
| Edinburgh, . | 4549 | 19,216 | 190,684 | 9,713 |

# THE PEOPLE OF ISRAEL;

## Their Numbers, Distribution, and Characteristics.

By V. Dingelstedt, Corresponding Member of the Royal Scottish Geographical Society.

The people of Israel, also called Hebrews, Jews, sons of Jacob, the Chosen Nation, though dispersed throughout the world, with no home, no land, no flag, no government of their own, are well worth the attention of geographers on account of their number, coherence, their ancient history, their sufferings and misery, their strong traditions, character, wealth and influence, talents and ability, strong faith in the future of their race, and desire to remain a nation. Persecuted throughout the centuries, martyrs to their faith, conquered, ruined, expelled, massacred, enduring a thousand wrongs, the Jews have remained a nation during three thousand years, bound by the ties of blood, faith, traditions, and common sufferings.

Jews (a term corrupted from Jehudius) or Hebrews (Ibri) are a branch of the Semitic family which, according to tradition, migrated from Mesopotamia into Palestine or Canaan about 2000 years B.C. Thence they went to Egypt, and after a long period of bondage, they, having increased in numbers, succeeded in conquering Palestine and settling there. They founded a glorious kingdom, and became an agricultural people. At about 975 B.C. they divided into two distinct states—Judah and Israel—and somewhat later these were overcome singly, and the people led into exile. In the course of their long history the Jews have only for short periods enjoyed peace and prosperity. Many times they were forced to abandon their native home and to wander in the wilderness. They were reduced to slavery, carried away captive; many times they were conquered, plundered, massacred and almost annihilated. By 80 A.D. hundreds of thousands of them were scattered in all parts of the world.

The ascendancy of Christianity brought them increased sufferings. Imperial edicts and ecclesiastical decrees vied with each other in their intolerance and rigour towards this unhappy, landless and homeless people. From the eleventh to the fourteenth centuries of the Christian era their history recounts an almost uninterrupted series of massacres. They were deprived of common rights, banished from many states or forced to remain within strictly limited frontiers (the Pale).

In modern times the Jews have obtained the common rights of citizenship in most countries, but they are isolated, disliked and often despised, and continue to suffer.

The writer of the present article is not concerned with the history of the Jews, neither does he propose to study their complicated religious views and dogmas; he would like only to give his readers, though may be but very imperfectly, an idea of what has become of the Jews in our

time, their numbers, distribution, activity and characteristics in various countries, where, after long wanderings, they have been permitted to settle.

The Jews have an exalted idea of themselves. They are intelligent, religious and moral, they respect the family: they have almost all the talents—commercial, industrial, scientific, artistic. *Judaism* may be conceived as a religious and ethical system of ideals in regard to social organisation, where the interest of individuals is mainly though not exclusively sacrificed to the welfare of the community. Its conceptions are sufficiently broad and rational, which explains the long survival of the race, notwithstanding persecutions, defeats, dispersion. The fundamental idea of Judaism is, however, not rational in essence, it is not an intellectual conception, but is intuitive, and its mainspring is to be sought in the will power, the depth of the feelings. Judaism is a matter for the heart. It is a powerful intuition which has dictated the laws governing the conduct of the Hebrews and framed their views about right and justice.

Judaism has a strongly national character. In its later development it had fallen victim to a narrow conception, according to which a correct action was considered as the one thing needful. The consequences of this assumption were disastrous, as with it was introduced into the very heart of religion and morality a mechanical, or quasi-material conception of life and duty. Spiritual freedom was crushed out by an evergrowing burden of narrow, rigid and despotic observances and rules. Such a multiplication of trivial rules, and the consequent oppression of spiritual freedom, is always sure to arise whenever correct action is regarded as an end in itself.

The Jews are a thinking nation, and they have produced some great philosophers. Spinoza, the greatest representative of Judaism, conceived, under the influence of Descartes, a most abstract system of Monotheism. "There is only substance, only God—nothing else." Treated at first as iniquitous and blasphemous, his idea has become the basis of German philosophy, and Schleiermacher called the Jewish philosopher "pious, virtuous, God-intoxicated." He was in fact a most disinterested and virtuous man.

Jews have exercised an immense influence on the Western world: they stamped it with their idea of Jehovah,—a personal God—excluding the more highly spiritual idea of God as conceived by Buddha. There were ups and downs in their struggle for a more dignified situation in the world. Sometimes they have fallen very low, morally, socially, economically: there were times when many of them have shown themselves capable of apostasy for quite small pecuniary considerations and worldly advantage: whilst again, in other times, and as it seems just now, they have raised their heads, and their hearts are full of new hopes.

The prevalent idea of the Hebrew literature is a passionate enthusiasm for independence. It would be vain to attempt to enumerate the names of those illustrious in general literature, in law, philosophy, medicine, philology, mathematics, belles lettres, etc., since there is not

one country in Europe which does not count Jews among the foremost and most brilliant representatives of its intellectual classes. By the unanimous verdict of the historians and philosophers of our times, the Jews are reckoned among the chief promoters of the development of humanity and civilisation.

## Numbers and Distribution.

The fatal date of the final dispersion of the Jews over the face of the earth, and therefore of the end of their national existence, was August 135 A.D., when, under the leadership of Barcochba, after a last heroic struggle, they succumbed to the arms of the Roman general Julius Severus.[1] Since then, one thousand seven hundred and seventy-seven years ago, the people of Israel have been wanderers; they settle where they are permitted to settle, under foreign laws, foreign governments, with no proper emblem of unity, amongst more or less hostile populations. It is the period of their history called the "diaspora."

Dispersed among other nations they have acquired a wonderful adaptability to their varied respective environments, and have learned to make the best of them.

They may have been three millions when they marched out of Egypt, they are probably four times this number now, or as many as the total population of Belgium.

Joseph Jacobs, in his "Studies in Jewish Statistics," estimated their number twenty years ago at seven millions.[2] According to the census taken in countries inhabited by Jews from 1890 to 1895 the total number of them has been estimated at 8,350,000;[3] they have increased in the last twenty years, and Dr. Nordau estimates them now at full twelve millions.

The Jews have now no longer a common history, scattered as they are over the face of the world, but have acquired many distinctions and peculiarities according to the climate, laws, character and institutions of the different alien nations and races they have been thrown among. They are to be distinguished as Russian, German, Turkish, English, French, Algerian, Portuguese, Moorish, and other Jews.

However, notwithstanding most adverse circumstances and cruel fate, the Jews have not completely lost their unity and coherence, and it remains even now possible to pick out a Jew among a most cosmopolitan and heterogeneous crowd. They have preserved their characteristic and easily recognisable features. Being everywhere an active and energetic element of the population, their activity has demonstrated itself as baneful or beneficial according to the treatment, the equity, toleration, degree of liberty and consideration they have received at the hands of those alien nations that have permitted them to settle in their midst.

The Jews have thus produced the most abject and the most splendid

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[1] Münter, *Der Judische Krieg unter den Kaisern Trajan und Hadrian.*

[2] *Scottish Geographical Magazine*, vol. viii. p. 54.

[3] *The Statesman's Year Book*, 1911.

types of humanity. Now in almost all civilised countries they have the full rights of citizens, but the experience of about one hundred and twenty years has taught them that these rights do not bring them the respect and the dignity they aspire to as an old distinct nation with a glorious past. With all the civil dignities accorded to them by existing laws they are despised, and set apart, if not directly persecuted. They have too long renounced their national worth and dignities to come into honour again as a nation. Hence, under the influence of awakened national feeling, they are striving towards the creation of an autonomous state.

*Russian* Jews, in south-western Russia, inhabit the ancient Poland, Litwa, White Russia, the lands of the Vistula, Bug, Disna, Dnieper, the provinces of Kovno, Grodno, Wilna, Volhynia, Podolia, Bessarabia, all these lands constituting the Pale or the home of Jews, with such big cities as Berditschew, Boelaia-Zerkow, Balta—"dirty Jerusalems" containing hundreds of thousands of Jacob's children. There are also some Jews in the Caucasus of very ancient standing. According to the census of 1890 there were in Russia, including Poland, 5,184,268 Jews. At the census of 1905, the number was 5,215,805, with exclusion of the Karaïms, who numbered 12,894. They are estimated now at being full six millions, or about the population of Bavaria.

The Russian Jews speak a jargon of corrupted German (Yiddish), which reveals their German origin: besides, they speak mostly all the languages of the people they have to deal with.

Jews have in Russia 6319 synagogues and 5673 rabbis. The Jewish population of Russia enclosed in the Pale is mostly poor and miserable, though it exercises considerable commercial, industrial and financial activity. This activity, however, directed as it is in the too exclusive interests of the Jews themselves, is tainted by fraud and deceit at the expense of the simple, ignorant and credulous Russian peasant, and is not considered beneficial to the nation as a whole: it does not increase its strength, and has even a demoralising effect. The Jews are inn-keepers, money-lenders, usurers, smugglers, pedlars, horse-dealers, tailors, locksmiths, etc.: they advance money upon crops at ruinous rates of interest. They are often a source of trouble to the government in consequence of the popular hatred they provoke, their discontent and revolutionary tendencies, their misery and hostile isolation from the Christian population.

Anti-Jewish restrictions of every kind are numerous and important; it would take too much space to enumerate them. They have in view the restriction everywhere of Jewish activity, which is considered noxious or injurious to the national interests, and aim at compelling the Jews to leave Russia.

As examples of those restrictions may be mentioned—the prohibition to own immovable property outside the Pale: the prohibiting the holders of certificates of private gymnasia to enter the universities; percentage restrictions for Jewish external students in the high schools; limitations in the powers of Jews to take leading positions in banks: prohibition to use Christian names, to inhabit villages, etc.

In recent times there have been some contractions of the Pale, when some small towns were converted to the status of villages.

The Russian people's attitude towards Jews is different from that of the English, but their position is also very different. Whereas the English have to do only with some 200,000 Jews, the Russians have them to the number of 6,000,000, and, whereas the English are themselves eminently a commercial nation, the Russians are in great majority simple peasants. The Russian government has to defend its people against an unscrupulous and skilful exploitation. Besides, the British and Americans themselves have found it necessary to restrict Jewish immigration.

Recently, in consequence of the murder of the prime minister perpetrated by a converted Jew, the Nationalists in St. Petersburg have passed a series of resolutions petitioning the throne for the removal of all Jews and sympathisers from public offices and from participation in the legislature.

Russians have to pay for their iniquities regarding their Jews population, and their neglect of the moral and intellectual education of this alien race. The Russian Semites have become audacious revolutionists, little disposed to consider the real necessities of Russian society as determined by history, religion and mental characteristics, yet prompt to sacrifice their lives for the expected realisation of theoretic views and doctrines as dictated by some scientific German bookmaker.

Though not aspiring to political independence, but only labouring under a feeling of their wrongs, they have furnished a considerable contingent to the revolutionary movement. Many have taken part in terrorist enterprises and have been executed. In 1897 they formed their own revolutionary society, or "Bund,"[1] which joined the Russian Social Democratic Labour party. Hundreds of thousands of Jews fell victims of the pogroms in Russia in 1905-6.

The work of Leo Errera, translated from the French by Bella Löwy, *The Russian Jews: Extermination or Emancipation*, reviewed by this magazine,[2] gives an account of the treatment of the Jews in Russia.

Jews are despised in Russia on religious grounds, also for their usury, their ability to make the most of their neighbours' weaknesses and faults, their slovenliness, want of dignity, their disposition to undertake for money every kind of labour, their hard heartedness, hypocrisy, greed, cunning, treachery, their secret ways, etc. etc.

In spite of bad treatment the Russian Jews are not seldom fondly attached to their adopted country; they are proud to call themselves Russians, and notwithstanding the obstacles to their education, they do sometimes succeed in acquiring respectable situations as jurists, medical men, scientists, merchants, bankers, etc.

According to Leo Errera the position of Jews in Russia has become intolerable since May 1882. They were then forbidden to settle outside the towns in the Pale of Settlement, or to acquire landed property:

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[1] Or "Universal Jewish Labour Union in Russia and Poland."

[2] *Scottish Geographical Magazine*, vol. xi. p. 206.

they have been expelled from some towns converted into villages. They had to pay higher taxes than other people, they had to suffer from increased difficulties in regard to the education of their children and from occasional explosions of popular hatred in the cruel pogroms. In view of this state of things, the Jews have initiated a movement of emigration, and in order to help the poor emigrants have organised an association under the name of *Ica*, which has already developed considerable activity.

*Austria-Hungary* comes after Russia as a home of Jews. At the census of 1890 there were in Austria 1,143,000 and in Hungary 725,222, a total of about 2,000,000. At the census of 1900 they had increased, and their actual number in both parts of the dual Empire may be taken as equal to 2,210,193, or almost equal to the population of Servia. Their influence is as great as their numbers. What was said of the Russian Jews may apply in some degree to the Polish Jews in Austria-Hungary, though of course they are here on a higher level.

*Austrian* Jews obtained their freedom in 1868, and with it they are growing influential and respected. In Galicia they form about 10 per cent. of the total population. The Magyar nobles employ them largely as bailiffs, and they fought under their lead as military officers in the struggle for independence.

Hungary has long shown much favour to the sons of Israel: many of them have become barristers, medical men, editors, journalists, booksellers, bankers, artists, musicians, etc. At the present time the Austro-Hungarian, as also the German press, is mostly in the hands of this people, who have thus gained an instrument potent in influencing the opinion of the world and the financial situation. Out of 1,000 officers in the Austro-Hungarian army there are 81 Jews. The "Israelite Club" constitutes one of the political parties in the Reichstag, exercising conspicuous influence on the political situation, siding, according to its interests, with one or other of two great contending parties—German or Bohemian.

*German* Jews, about 750,000 strong, mostly inhabit the Polish Provinces of Prussia, their number there being calculated at about 423,000. After Prussia, in the order of importance of Jewish population, come Bavaria with 9 per cent. of the total German Jews, Alsace-Lorraine 5 per cent., Baden 4·2 per cent., Hesse 4 per cent., Hamburg 3·2 per cent., Saxony 2·4 per cent., Würtemberg 2 per cent. The remainder are distributed in relatively small numbers in Oldenburg, Saxe-Meiningen, the Duchy of Saxony, Bremen, Lübeck, Mecklenburg-Schwerin and Reuss.

It is to Germany that in modern times belongs the honour of human treatment of Jews, and it was a German Jew (Moses Mendelssohn) who was the first to induce his co-religionaries to reconcile themselves with the spirit of the age. He has thus germanised Jews and weakened and partly destroyed their allegiance to Judaism.

From the establishment of the German Empire the sons of Israel were admitted to public posts. The legislation with which the empire was inaugurated gave to them political and civil equality throughout

Germany. Under this régime of equality and toleration the German Jews have developed considerable prosperity, but they have never allowed the old spirit of discontent and sectarian dissension to become dormant.

Germany has produced a great number of eminent Jews in all branches of useful human activities, learned rabbis, and world-renowned jurists, barristers, philosophers, scientists, artists, financial and medical men, merchants, leaders of industry, philanthropists, moral and social teachers, etc. etc. The rabbis take care to instruct their people, but do not always succeed in preventing apostasies. There are many Jewish educational institutions.

Jonas Fränkel in 1854 established the Judaeo-theological Seminary in Breslau, an institution which has provided Germany, Austria, England, and the United States with many rabbis. Of later date are the high school of Judaism, founded in 1872, and the "Seminary for Rabbis for orthodox Judaism," under Dr. Hildesheimer, established at Berlin in 1877.

The *Deutsch-Israelitische Gemeindebund* counts about one thousand Jews' communities, each of whom send yearly its delegates to an assembly in some town, at which common interests are freely debated. There is also in Germany an influential *Verband der Deutschen Juden*, and *Rabbiner-Verband*, and a number of other Jewish institutions.

German well-to-do Jews go over to Protestantism. Those Jews who buy land from their former Polish proprietors in Posen and found a Majorat are raised into nobility. Though enjoying equal rights before the law, the situation of Jews in the army, and the so-called liberal careers, instruction and administration, is far from enviable. There is as yet in German society an unconquered anti-semitic feeling. Jews cannot obtain officer's rank, and only in the sanitary corps may they obtain the position of *Hauptarzt 1 Klasse*.

There are some Jewish officers in the Saxon, Bavarian, and Wurtemberg troops; there were also some in the Prussian army, but since 1885 no one Jew has ever been nominated either in the active or in the reserve army. There have been recently some protests against this iniquity on the part of certain Jewish associations, and though the justice of such a protest was recognised in high places, yet the officers maintaining a strong prejudice against the Jews, and the nominations being made by the Emperor according to the lists presented by officers, there is as yet not much chance for them. On the whole, the German Jews are rather disaffected.

*Turkey.*—After Russia and Austria-Hungary, it is the Mussulman empire which keeps in its possession the two most ancient homes of Hebrews, Mesopotamia and Palestine, that includes the greatest number of them, and is perhaps destined to become for them again a Land of Promise, where they may establish themselves, or enjoy some kind of autonomy. There are a considerable number of Jews in Constantinople, but the exact number, probably variable, is far from being ascertained. Twenty-six years ago they were 44,361; perhaps they are 100,000 now. They are certainly above half a million in the whole Turkish Empire. They are distributed through the empire; in Asia Minor there are 184,600,

Armenia 30,700, but most occur in Syria—Beyrouth 136,900, Aleppo 20,000, Lebanon and Jerusalem 80,000.

A number of Jews, expelled by Ferdinand from Spain, have found refuge and consideration in this Moslem country. A large Jewish colony in Alexandria was founded by Alexander the Great, who carried them from Palestine. After him, Ptolemy invaded Syria, took Jerusalem (301 B.C.), and carried off 100,000 of its inhabitants, whom he forced to settle chiefly in Alexandria and Cyrene. The Egyptian dispersion gradually spread over the whole country, from the Libyan desert to the boundaries of Ethiopia, over Cyrenaika, and part of Libya, and along the borders of the African coasts to the Mediterranean. The Jews enjoyed equal rights with their fellow-subjects, and were admitted to the highest dignities and offices. Turkish Jews keep the public instruction of their co-religionists in their own hands: their great rabbi is the Minister of their schools, in which the instruction of French is pursued with success.

Judaism in Turkey is one of the seven religious denominations invested with the privilege of possessing their own ecclesiastical rule. The Jews in Constantinople are governed by a kaimakam appointed by themselves, and salaried by the Government. Outbreaks of religious hatred occur in Smyrna, Rhodes, etc., but the Jews suffer now under no disabilities, and are admissible to offices. The Jews in Jerusalem are occupied in studying the Talmud. To maintain them in this hallowed indolence the Jews throughout the world send annual contributions (haluka) amounting to about £50,000. The rabbis administering these funds regard Jerusalem as one of the great rabbinical colleges of the world. All the important sects are represented here, each sect dressed in its particular way.

The general condition of the people of Israel in Turkey is far from enviable; they are despised alike by Turks and Christians; many consider them as traitors capable of betraying their best friends. There are many popular prejudices against them, and the common Jews have a very uninviting appearance. They speak among themselves a jargon—a corrupted mixture of Spanish and Italian: many serve in the secret police, but the majority are money-lenders, pedlars, brokers, small traders, artisans, men of all trades. Even the small Jewish children peddle cheap kinds of ware.

The Zionists hold that it is to Turkey that Jews must emigrate to save themselves from misery, distress, and uncertainty. It is the only land that has not, on principle, shut its frontiers against the immigration *en masse* of persecuted Jews and refused them agricultural settlement. But there is disagreement among the Jews, and there are a number of them who are violently opposed to the emigration of their co-religionists into Turkey: they incite authoritative circles in Turkey to hostility against Zionists, and denounce them as agents of the German government, or as incorrigible revolutionaries who want to worm their way into Turkey in order to seize Palestine, to unfold the banner of revolt, and to proclaim in Jerusalem an independent kingdom of the Jews.

According to the *Jewish Chronicle*, the general Jewish colonising

organisation has acquired a territory, 10,000 acres in extent, at Rapha, in the El Arish district, for the purpose of founding a colony. In Biblical days Rapha formed part of Palestine: it is situated within the area offered in 1903 by the Egyptian government, at the instance of the British authorities, to the late Dr. Herzl, leader of the Zionist movement. Zionists have also acquired extensive lands in Damascus and Haifa, and have succeeded in increasing the prosperity of Palestine, where, with the assistance of Jewish banks, have been created manufactories of oil, soap, cement, and machines.

The Colonial Bank disposes at the present time of a sum of £200,000, and it helps private individuals to acquire landed property, construct dwellings, and buy machines. Another financial establishment of the Zionists is the "National Jewish capital," gathered by gifts: it has attained already 140,000 f. (£5600). Thanks to this resource, and some other funds granted by rich men, the Jews have succeeded in creating in Palestine many useful institutions, such as an agricultural Model Station, schools, workmen's houses, libraries, etc.

*Roumanian Jews.*—At the census of 1899 there were here 269,015 Jews, or about 5 per cent. of the total population of the kingdom. Since times immemorial there have been numerous Jews keeping the village inns, and forming centres for the commerce of their districts. They travel through the country to buy or advance money upon the crops and to sell foreign merchandise. They also exercise many handicrafts—glaziers, locksmiths, tinmen, horsedealers, tailors, watchmakers; they build metal roofs and pinnacles of churches. Their communities belong to both divisions of the modern Jews. The principal bankers are Jews. The wealthy families educate their children well and hold a good position in society. There have been, however, frequent popular outbreaks against the Jews.

*French* Jews, which occur in about the same number as British ones (200,000), have enjoyed since the great Revolution equal civil rights with all Frenchmen. The most powerful impulse to their political liberation in other civilised countries came from France.

They are most active and influential, are engaged in almost all branches of industry, and in financial, commercial, technical, and scientific activities, but suffer, nevertheless, at least in some quarters, from undying prejudices and even violent antisemitism.

There is no distinction between reform and orthodox congregations as in Germany: but the French Jews are still distinguished as Spanish and Portuguese, on the one hand, and Polish and German Jews, on the other. No doctrinal distinction exists between the two divisions, and they intermarry freely. The Jews of German rite are now much more numerous and wealthy in Western Europe than the Spanish Jews, though the latter have long been considered as more cultured.

French Jews occupy now in the press and the theatre a very conspicuous place; they are even accused of monopolising these two important branches of national activity. This enviable situation, due to the intelligence and talents of Jews, provokes not unnatural hatred on the part of the so-called "Nationalists" and monarchical parties ("Camelots

du Roi"), whose organ, the *Libre Parole*, daily attacks the Jews in the most violent language.

In France there was no need for separate development of Judaism, thanks to political liberty. Many Israelites have occupied high civil and military posts: many have become indistinguishable by religious practice from the main body of the citizens.

To alleviate the fate of the Jews suffering from persecution and relieve their distress in Turkey, Russia, Morocco and other communities, there has been organised in France as a result of the efforts of an English Jew, Sir Moses Montefiore, the *Alliance Israélite Universelle* (1860), which has subscribers in all parts of the world, though Israelites are far from being unanimous in supporting it. The *Alliance* and similar societies of a more national character in London and Vienna helped at the Berlin Conference in 1878 to procure some alleviations for the Roumanian and Servian Jews; as also two years later at the Madrid Conference for the Jews in Morocco. The *Alliance* also maintains or assists schools for boys and girls in North Africa and in Turkey. In this task it co-operates with the Anglo-Jewish Association, the Board of Deputies in London, and the Alliance in Vienna.

*British Jews.*—There are in England about 200,000 Jews (38 per cent. of them in London) and 200 synagogues or rabbinates. In the last twenty years their numbers have increased about 48 per cent. At the census of 1891 there were in Ireland 1798 Jews, in the next decade their number increased to 43 per cent.: there are now about 4000. There are practically no Jews in Scotland.

No kind of civil inability accompanies any religious conviction in the United Kingdom: the principle of toleration was realised gradually until in 1858 the Jews were admitted to sit in Parliament. Save for some remaining peculiarities in point of law the Jews in England are on an equal footing with other citizens. There is a Jewish Religious Union.

*English Jews*, being few in number, were not visited in modern times with special disabilities, but suffered from the general operation of the Test Acts, which excluded them from political, civil and municipal offices, from the bar, etc. Early in the eighteenth century there began first an immigration of Spanish Jews, which supplied such converts as Isaac Disraeli and his son Lord Beaconsfield, and later, in large numbers after the accession of the house of Hanover, came the German Jews. English statesmen soon perceived what an important contribution the business ability of the Jews was capable of rendering, but the electorate long maintained its prejudices. It was only in 1846 that there was formally repealed the obsolete statute "De Judaismo," which prescribed a special dress for Jews.

The Jews' Free School in London is perhaps the most efficient elementary school in England. Jews in London form a respectable community, but there is also a criminal gang, inhabiting the East End, and giving much trouble to the police. The respectable Anglo-Jewish community is doing its best to raise their miserable brothers: they have organised a Jewish Board of Guardians, but the problem is a

hard one. The poor Jews are recruited mostly from Russia, they do not know much English, they speak Yiddish among themselves, and they are mutually helpful. The alien Jews give employment to the people of their faith, they deal with one another, live together, and gradually oust the Englishmen as successful competitors. The number of alien Jews arriving yearly in London, but not always remaining there, has been calculated at 20,000 to 25,000. They work for Yiddish employers, read Yiddish newspapers, buy in Yiddish shops, and enjoy themselves in Yiddish clubs and theatres. Public notices are posted for them in Yiddish, and there are even policemen specially taught Yiddish to help them in trouble. As in many other great cities in France, Germany and Switzerland, there are many boarding houses and educational establishments for the children of Israel.

England reaps excellent fruits from its humane and equitable policy in regard to Israel. English Jews do much honour to their adopted country, they occupy in every class of the nation a most respectable situation, they are in the civil service, they have been distinguished by Knighthoods; in the Indian army there are many officers of Jewish origin, and there is no branch of useful human activity, scientific, political, social, literary, industrial, commercial, or financial in which they have not rendered eminent services to England. Also the English Jews are considered as being superior to the Jews of other countries.

*Italy.*—Italians have allowed the many Jews expelled from Spain to settle in their towns, and to open schools and synagogues. At the census of 1881 they numbered 38,000. In the next twenty years they decreased to 35,617. There is a considerable number of Jews in Sardinia, relegated there at the time of Vespasian, but converted mostly to Christianity. They have conserved some of the ancient usages, as, for instance, funeral songs (*attittu*), lasting a whole day, about an object specially precious to the deceased.

Till 1847 the Jews were not permitted to leave the Ghetto, and their conversion was sought by most oppressive means. The Kingdom of Italy brought to them freedom and political equality.

*Holland* was one of the first Christian countries affranchised from the prejudices against Jews. It allowed them the common rights of citizenship at the end of the eighteenth century. There are about 90,000 Dutch Jews.

The Jews were admitted in *Denmark* as rightful citizens at the time of the French Revolution. They now number above 100,000.

In *Sweden* the rights of citizenship are conferred on Jews only as a favour. In *Norway* the Jews were not tolerated till 1860. In both these northern countries they number about 3000.

There are Jews in smaller numbers in some other countries, viz.: in Persia, about 35,000; in Switzerland, over 19,000; in Bulgaria, about 38,000; in Belgium, 14,000; in Greece, 3000; some hundreds in Portugal and South Africa; and about 4000 in Spain.

*New World.*—Though not inclined to travel much on the sea, many Jews, to seek refuge from persecution, have crossed the oceans to America and Australia. It is not easy to know their exact numbers

in the United States, as there is no national system of registration, and as such an active immigration is going on. There are 1769 acknowledged Jewish congregations. At the census of 1906 there were counted 101,457 Jewish heads of families. The two censuses of 1890 and 1910 have given respectively the numbers, 130,496 for the former, and 143,000 for the later year, but these are members of congregations as distinct from heads of families. Lately the numbers must have considerably increased through the immigration of Russian Jews.

In the American Jewish congregations there exists a pronounced tendency to reform, but there are also considerable conservative forces, which oppose themselves to any modifications of traditional teaching, and endeavour to effect a great union of Jews in America "for the clear conception and faithful performance of a true and noble Jewish life."

The condition of the Jews in the United States, though they do not suffer from any inequalities attached to their religion, is far from being happy, and not a few Jews, having emigrated from Russia to America, have returned to their old home after painful experience. Among the American Jews is observed a curious spirit of *Wanderlust*, a feverish dissatisfaction with existing conditions, a wild desire to roam from city to city, frequently resulting in destitution. The desertion of wives by their husbands has increased to an alarming extent. There has developed a special type of Jewish tramp, and according to some noted Hebrew publicists he is often a person of unusual talents, who cannot fit into the conditions surrounding him.

*Australia.*—New South Wales includes 6447 Jews; Victoria, 5907; Queensland, 733; South Australia, 786, West Australia, 1259; Tasmania, 107—a total according to the census of 1901 of 15,339—a very small increase as compared with the preceding decade (14,938).

*New Zealand*, at the census of 1906, included 1867 Jews, a small increase compared with the preceding decade.

The association known under the name of *Ica*, though as yet at its beginnings, has operated successfully in Brazil, Argentina, Canada, and the United States. It has demonstrated the agricultural capabilities of the Jew, and it is considered in Jewish quarters that it may considerably extend its operations, especially in Canada.

## Character and Intellectual Powers.

It is a delicate matter to describe a nation's character, and the difficulty of the task is particularly great in the case of this people of Israel, which includes such a great diversity of personal merits and characteristics, and mingles in an inextricable chaos so many different features. What is said here concerning their general characteristics and temperament refers to the common people, and is liable to numerous exceptions. The Jewish character has been formed under manifold influences. The geological and climatic conditions of Palestine, the

racial peculiarities, glorious traditions, long history of martyrdom and persecutions, different local conditions according to the countries where they were obliged to seek refuge after their final dispersion (diaspora), have all had their influence.

The effect of geographical influences on the character of Jews has been well demonstrated recently by Mr. Huntington, Assistant Professor of Geography in Yale University, in his remarkable work—*Palestine and its Transformation.*[1] He observes that Jews are what they are because they inhabited Judaea, and fell under the influence of the geological and climatic conditions of this narrow, rocky plateau, with its peculiar physical form. "The Jews who evolved their high ideals of loyalty to a single God were . . . quiet, secluded people to whom traffic was far less noble than agriculture; to them the sea was something strange and distant, something inhospitable and terrible."

But the modern Jews have learned to traverse great expanses of water without fear. They have become accustomed to resist the influence of different climates and soil. It is their wonderful history, the remembrance of past glories, the hardships and sufferings to which they were so long subjected, the persecutions of which they were and are still the victims, their religious and moral doctrines, their faith in their future destiny, all these, more than the geographical features of their native country, have contributed to shape the character of the Jews, to form their many solid virtues and their not less numerous defects and unattractive features.

There is an undoubted greatness in the Jewish character. That this homeless people, without any political organisation, any normal social constitution, persecuted for many centuries, deprived of almost all human rights, though often fallen and vanquished, did not perish as so many other nations did, is explained by the fact that it has demonstrated on the whole a wonderful faithfulness to its religious and national ideal, only occasionally interrupted by deplorable periods of discouragement and infidelity.

After their final dispersion, homeless, without any fixed place of residence, with no roots in the present, deprived of autonomy, the Jews, according to Dr. Pasmanik,[2] concentrated all their energies on saving their national soul as a guarantee of their future. In the faithful remembrance of their glorious past they have shown themselves capable of supporting patiently abasement, degradation, torture and persecution.

Israel has become a nation inspired by hope. In absolute foreign dependence, without power to direct its destiny according to its own designs, a plaything of fortune, the people of Israel, degraded and dishonoured, has maintained its faith in Messianism, the future reign of God in Zion. According to Dr. Pasmanik, the Jew does not know transitions, he does not understand shades or delicate gradations. He is as absolute in his hope as in his despair, in his activity as in his passivity, in his manifestations of strength as in his impotence. He is of one mould: he either creates things divine or he destroys everything

[1] London: Constable and Co.

[2] *Die Seele Israels*, Köln and Leipzig, 1911.

divine, he is either a stubborn laggard or a hot-blooded destroyer. He is absolute in creative power, and then he creates such things as the eternal Bible, with the Song of Songs, and the never-to-be-forgotten Psalms. He is also absolute in his negations—then he worships alien idols, he undergoes a slavish assimilation, wherein remains no trace of individuality. It is a nation of extremes, destitute of the faculty of contemplative and peaceable development, *Ein Dogmenvolk*.[1] Hence there are many irreconcilable points in Jewish character; they are virtuous and hypocritical, shrewd and deceitful.

In the character of the Jews is to be found an ethical spirit, a passion for the moral judgment of human societies, for the laying bare of their falsehoods, the condemnation of their social prejudices—an aggressive feeling against all moral wrongs. All great Jews from antiquity up to our modern times have all been passionate and one-sided moral teachers and censors.

According to the brilliant Italian sociologist, Guglielmo Ferrero, the Semitic genius has let fall bundles of solar light among the gloomy abysses of life. The ethical spirit is innate in their souls: they dream of social regeneration, and they hope to obtain supremacy in this regenerated world.

In our time the Jew has become a shrewd financier and a typical representative of commercial acumen. "To jew" signifies in popular language to cheat, to swindle. Profound connoisseurs of the human heart, and highly inquisitive, the Jew knows almost everything about every one he has to deal with; he detects secrets, he knows one's weaknesses and foibles, and he plays on them with a consummate ability. Himself impenetrable and unchangeable, he reads a human soul as in an open book, and with none or but little scruple he takes full advantage of his penetration. He knows how to make himself not only serviceable, but also indispensable. In the countries where Jews are established, they are almost ubiquitous, and they know everything. One may despise them, but one cannot dispense with them.

Jews are very ambitious, but they have learned to succeed better by affecting humble ways: they are patient and hypocritical, and do not reveal their triumph till they are quite certain of it. A Jew shows himself eager to furnish a light-hearted Polish or Russian landlord with all the funds necessary for his prodigality, he encourages him to borrow more and more, he facilitates in every way the other's ruinous indebtitude, playing on his vanity and *amour-propre*: but all the time he maintains the humble attitude of a devoted servant, whose sole care is to be helpful to those who honour him with their confidence. He will wait hours and hours in the ante-chamber till a high personage deigns to admit him to his presence, bow profoundly when once admitted, speak in mellow submissive tones, though knowing well that he, the "poor Jew," is already in virtual possession of all the goods of his grand supercilious creditor, that he has already succeeded in crushing him and has only to produce some stamped papers to be put into legal possession of all his goods.

[1] Dr. Pasmanik, *Die Seele Israels*, p. 10.

"*En avoir pour son argent*," the faculty of getting the full value of one's money, is very conspicuous with Jews. They know what is money's worth, and thanks to their money they obtain and enjoy many things accorded to others and refused to them, for no other reason than that of their being Jews.

Thus they have partly taken their revenge for the injustice and persecution of Christians. They have learnt that money alone can alleviate their situation and give them consideration, and with wonderful skill, perseverance and activity, they have heaped together money by all means, by commerce, industry, usury, banking. They have succeeded in obtaining great financial power. Money gives them influence in the politics of nations and gives them also through journalism the means of influencing public opinion.

Once a nation of high-spirited warriors, the Jews are often unfit for military service now, and they are not tolerated as officers in European armies. They lack "*point d'honneur*," the particular susceptibility to one's honour proper to soldiers. City life has rendered them also mostly unfit for agriculture.

Jews are a nervous, sensitive people. They are more disposed to diseases of the nervous system than Christians, though, thanks to their sobriety, they are but seldom subject to epilepsy.

Their long sufferings from persecution and privation, and the always precarious state of their welfare, the hard struggle for existence, has developed in them a tendency to heart disease from arterio-sclerosis, and diabetes. Both diseases united often attack Jews even in youth and middle life.

Jews of all nations contract the greatest number of consanguineous marriages: the ratio to the total number, per 10,000 marriages, being 230, while in England it is only 75. They marry less frequently, have fewer births, greater longevity, and increase at a greater rate than Christians. They have fewer still-born and illegitimate children than other races.

The Jews' character is that of an old, highly evolved nation having adapted itself to all latitudes and geographical conditions, and being wrought under the hammer of adversity into obdurate forms. According to Goethe they are the most persevering people on the earth: "*Es ist, es war, es wird sein.*"

The actual situation of the people of Israel, with the exception of some civilised states where they are only in small numbers, is deplorable. In his presidential address at the opening of the tenth Zionist congress, the celebrated Dr. Nordau said, among other things: "The Jewish people is to-day experiencing the most gloomy days of its history in the diaspora. All our sentinels give us but one report: 'Foes on every hand.' The plague of antisemitism, which everywhere and always had an endemic hold, is at present marching round the whole earth as if it were an epidemic. Jew hatred, which even in the short intervals of deceptive quiet is never completely extinguished, is now breaking forth everywhere into white flame."[1]

[1] *The Jewish Chronicle*, August 18, 1911.

The Jews on their side do little to mitigate the ill-feeling they commonly inspire. They pursue everywhere their special interests and their own mode of life; they have their peculiar chronology, their own feasts, they do not recognise Sundays, they have many usages and practices in disaccordance with those of the communities they belong to. They have got influence and money, but the power which procures money does not give the respect, consideration, sympathy, and affection they need in order to rise in dignity in their own eyes and among other nations of the world. Notwithstanding their wealth and money they are not liked, and very often they are despised.

There are for them three different roads out of their difficulties—assimilation to their surroundings, national orthodox Jewish unity and Zionism, or the formation of an autonomous state. But each of these roads is barred by formidable and perhaps insuperable obstacles.

## GEOGRAPHICAL NOTES.

### Asia.

**The Forests of the Philippines.**—Professor Paul Goode contributes to the *Bulletin* of the American Geographical Society a paper on this subject, based upon the publications of the Philippine Bureau of Forestry. Of the 120,000 square miles which constitute the total area of the archipelago no less than one-third, or 40,000 square miles, remain in the condition of primaeval forest. About 20,000 square miles are covered with a second growth of forest, 48,000 square miles are in grass land, and only 12,000 square miles are under cultivation. Of the cultivated area, not more than half is under cultivation at one time, so that the total population of the islands, about 8,000,000 persons, is supported by the cultivation of only 5 per cent. of the area. The origin of the grass lands is exceedingly interesting. In order to prepare land for cultivation the trees are partially cut down, and the branches, etc., after drying, are fired: rice, sweet potatoes, Indian corn, etc., are then planted in the soft ash. But after one or two crops have been taken off, the cogon grass begins to take possession, and its network of roots and its rank growth make it impossible with primitive implements to get a crop from ground which it has invaded. The patch is therefore abandoned, and a new clearing made, so that the grass land is continually extending. The fact would be of less consequence were it not that the grass is practically useless for fodder, and thus these lands are unproductive. Under natural conditions the forest would doubtless encroach upon the grass, but here again man interferes. His forest fires destroy all young seedlings, for in the dry season these areas of rank grass burn rapidly, though the grass springs afresh after the burning. Obviously then the administration has some serious problems before it.

The forests themselves are arranged under a number of different headings, but the important point is that they resemble tropical forests

in general in their great number of species. It is estimated that some 2500 species of trees occur, and in one case no less than eighty species were counted in an area of one acre in extent, while of these only two reached a merchantable size when mature. Fortunately, however, the Dipterocarps, which reach a great size and can be used to furnish construction timbers, tend to occur in pure stands, in a fashion that will justify the use of modern logging methods. In all about one hundred species may be reckoned on as of commercial value. Meantime a large amount of timber is imported into the archipelago from America. Among the minor forest products it is noted that there are hundreds of square miles of nipa swamps, and the sap from the flower stalk of this palm has a very high sugar content, and can be used to produce commercial alcohol.

### America.

**The Ice Age in Bolivia and Peru.**—Professor Rudolf Hauthal undertook in 1907-8, with the assistance of Professor Hans Meyer and the *Gesellschaft für Erdkunde zu Leipzig*, a journey in Bolivia and Peru. The prime object of his journey was to investigate the former extension of ice in the Cordillera in this region, but incidentally he made a great number of other observations, and his results, with maps, sketches and illustrations, are published by the Gesellschaft as *Reisen in Bolivien u. Peru.* We shall limit our brief note on this pamphlet to a consideration of the results obtained in regard to the fundamental problem, but those interested in the region will find a considerable amount of information in regard to it in the book.

Professor Hauthal recognises two Glacial Periods in the Cordillera here, anterior to the present glaciation, and his observations are sufficient to enable him to indicate approximately the limits of the névé and of the glaciers in the various parts of the mountains studied, during these different periods. It may be sufficient if we note his figures for the Eastern Cordillera in the middle of Peru. Here the névé limit during the first period was probably 4400 metres (14,400 feet); during the second period 4800 metres (15,700 feet); and is at present 5200 metres (17,000 feet). For the glaciers the corresponding figures are 2800 metres (9100 feet), 4000 metres (13,100 feet), 4800 metres (15,700 feet). A similar relation between the different figures is observable in other parts of the chain, and, according to the author, these figures permit the following conclusions to be drawn:—The limits of the névé in all cases during the three periods lie parallel to one another, the figures being always lowest for the first glacial period. This means that during the two glaciations the local climatic conditions here, as in South America generally, had the same effect as at present, but the climate as a whole was colder and precipitation was probably greater. Taken in conjunction with the accumulating evidence that the Ice Period occurred simultaneously over the whole globe, these facts lead to the conclusion that the cause is to be sought outside the globe, *i.e.* was of a cosmic nature. No cause having a local effect on special regions of the globe can account for all the phenomena.

## Polar.

**Western Antarctica.**—Dr. Nordenskjöld publishes as the first part of the *Wissenschaftliche Ergebnisse der Schwedischen Südpolar Expedition 1901-3*, a general account of the expedition (*Die Schwedische Südpolar-Expedition u. ihre Geographische Tatigkeit*). The book, which is copiously illustrated with maps and plates, consists of three parts. The first summarises the work of the expedition, and the contained facts have therefore already been discussed here. In the second part Dr. Nordenskjöld gives an account of the history of exploration in the region covered by the expedition, together with some discussion of the vexed question of nomenclature: while the third part describes generally the geography of Western Antarctica.

From this third part we extract a few important facts which have emerged from the work of the various expeditions of recent years, especially of the Swedish expedition. It is now clear that Western Antarctica can be divided into three regions, chiefly on geological grounds. These consist first of the Antarctic Andes, the continuation of the great American chain of the same name, which runs down the west coast of the West Antarctic mainland (Graham Land, etc.), and includes also the neighbouring islands and Joinville Island. Though this chain reaches no very great height the scenery is of a very wild alpine type, as shown alike by the photos of the Swedish and French expeditions. Its rocks are plutonic, chiefly granites, etc., with schists. To the outside of this folded chain lies the second zone, separated from the former by the wide Bransfield Sound, doubtless a rift valley, and including the chain of islands, mountainous in nature, formed by the South Orkneys and the South Shetlands. The rocks here are mostly porphyrites with modern lavas. Finally, on the east coast, the region specially studied by the Swedish expedition, there occurs a characteristically tabular form of topography, where the rocks consist either of basalts and other volcanic materials or of Cretaceous and Tertiary beds lying nearly horizontally.

In regard to the observations made on glacial phenomena, the most important general point is that, in contrast with Arctic lands, the region of snow accumulation extends to sea-level, or close to it, giving rise to types of glaciers (ice-foot glaciers, shelf-ice, dome glaciers on small islands, etc.) which are absent elsewhere, while, conversely, the familiar types of glaciers produced by melting on the lower grounds are here absent. The cause of these peculiarities is to be sought, according to Dr. Nordenskjöld, in the low summer temperature, which permits snow to accumulate close to sea-level even in summer time. The cold summer temperature he ascribes to the great extension of the ice in the vicinity of the Pole, this in its turn being partly due to the presence of high land there instead of sea, and partly to the persistent effects of an earlier period, which permitted the accumulation of masses of snow and ice over this great plateau. The ice-covered plateau causes the formation of a high pressure area from which polar winds sweep out and lower the summer temperatures in the surrounding regions.

But the glaciation of the Antarctic area is relatively recent. The Swedish results show that in mid-Tertiary times there occurred in Western Antarctica a rich flora, similar to that still found in South America. Between Tertiary and post-Tertiary times the climate altered for the worse, and that extensive accumulation of ice and snow took place which still so markedly influences the present climate. Dr. Nordenskjöld states that there is no strong evidence either for or against the supposition that the ice is now diminishing in the region studied by his expedition. Round Snow Hill, at least, it is certain that in the period just closed there has been no marked retreat of the ice; it appears to be stationary.

Finally, it seems clear that the different parts of the Antarctic continent in general have very different characters: the various regions probably resembling the adjacent lands, as West Antarctica resembles South America. These diverse regions, once probably connected with the different southern lands, now form one great region, characterised by its isolated position, and its almost unique climate, the latter especially differentiated by the great extension of the land-ice, and the peculiar forms which this takes at the margins of the continent, at the junction between land and sea. While now the Antarctic area is extraordinarily poor in species of plants and animals, its various regions probably once possessed forms of life similar to those of the adjacent continental masses.

## Commercial Geography.

**Transport of Perishable Food-stuffs.**—Mr. H. Hitier contributes to the *Annales de Géographie* a paper on recent developments in the trade in perishable commodities, such as dairy produce, eggs, fruit, early vegetables and so forth. Formerly this trade used to be regarded as one in objects of luxury, but now, with the rise of wages, the demand is increasing, and the large industrial towns are drawing to themselves supplies from a larger and larger radius. In southern France and Italy especially strenuous efforts are being made to promote this trade, both by care and attention in the matter of selection and packing, and by the organisation of special trains. Spain still remains far behind and is sharing but little in the new developments.

The demand for these products is greatest in Great Britain and in Germany, and, speaking broadly, France possesses most of the English market, while Germany looks rather to Italy for its fruits, vegetables, etc. The author ascribes this partly to political causes, but notes that France is now making successful attempts to capture the German market also. The P. L. M. Company especially, by sending representatives to all the industrial countries, and by a careful consideration of local demands, no less than by the arrangement of its traffic, is succeeding in developing the trade to an increasing extent. Other French companies are following this example, and it is noted that the French railway companies are endeavouring to supply the provincial towns of Great Britain direct, and avoid the risks attendant upon delay in London. Thus, during the plum season, plums are sent off in the early morning

from Montauban, and by special arrangements of trains and boats reach the markets of Manchester and Edinburgh direct, in the early morning of the second day afterwards. The time taken to Manchester is about forty-four hours, to Edinburgh about forty-eight. The organisation of which these figures afford evidence suggests one reason why the fruit of the English fruit-growing district is said not to pay the cost of gathering.

In Italy the State is similarly paying great attention to the traffic in perishable goods, and special trains, in the different parts of the country, act as collectors of the produce. Even with all these efforts, however, the producing countries in Western Europe cannot supply the demand, especially for such articles as butter and eggs, which are more and more being brought from Russia and Siberia. The Russians, profiting by their vast extent of territory, homogeneous in population and administration, are more and more utilising freezing chambers on their trains, thus taking a lesson from the United States, where similar conditions prevail. In Western Europe such wagons have only been used on a very small scale, and then within the frontiers of individual countries only.

**Geographical Distribution of Rice Cultivation.**—Dr. C. Bachmann contributes to a recent issue of *Petermann's Mitteilungen* a paper on this subject, based upon more reliable statistics than have hitherto been available. He calculates that in Asia some 600,000,000 human beings live upon rice. The extent of land under this crop diminishes steadily eastwards, where it has to compete with wheat and barley, but even in Asia Minor rice remains an important crop. In other parts of the world only Africa contains a considerable rice-eating population, estimated at a total of 28,000,000. Except in Madagascar and the adjacent islands the rice-eating peoples mostly occur in West Africa. In South America rice is becoming increasingly important in Brazil and Guiana, as well as in the West Indies, the product being chiefly imported into the last-named. It may be estimated that there are some 10,000,000 rice-eaters in this part of the world. Elsewhere rice is grown on a large scale in the southern United States and in north Italy, but the number of persons using it here as their main food supply is not large. Thus out of a total world population of some 1,600,000,000, 640,000,000 or about two-fifths live chiefly upon rice, making it, next to wheat, the most important human food-stuff. In addition, in many parts of the world rice forms an important auxiliary food, and has also a subsidiary importance as an article of trade. Its wide distribution is accounted for by its productivity, its digestibility, and its non-heating nature, which makes it valuable as an article of diet in hot countries.

The most favourable conditions for its growth are, as is well known, found in monsoon lands, and in Further India especially it is grown on an enormous scale. Thus in Lower Burma 92 per cent. of the cultivated land carries rice, and in Siam the percentage is scarcely less. In China, where exact figures are wanting, it is at least certain that it is grown on a far larger scale in the south than in the north, the south

sending large exports to the northern provinces. In Formosa 60 per cent. of the cultivated land carries rice. In Japan the mountainous nature of much of the country keeps down the percentages. Thus in Hondo, the north has 60 per cent. of rice lands, but in the mountainous centre the percentage falls to 47. In Yesso, despite the unfavourable climate, rice covers 10 per cent. of the cultivated surface. In India proper there are great variations, ranging from 74 per cent. in Assam and Eastern Bengal to 8 per cent. in Bombay, and 3 in the Punjab. The great development of plantations in Ceylon reduce the percentage there, and lead to a large import of rice. The extraordinary extension of rice cultivation in the monsoon lands is scarcely paralleled elsewhere.

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**Personal.**—At the Summer Graduation Ceremony at Edinburgh University on 5th July, the degree of LL.D. was conferred upon Colonel Bailey, R.E., formerly Secretary of the Royal Scottish Geographical Society and Lecturer on Forestry in the University.

The dean on presenting Colonel Bailey for the degree, said—

"Our late Lecturer on Forestry, while still a young officer in the Royal Engineers, was attached to the Indian Forest Department, where his thorough and excellent work earned high official commendation. As superintendent of the survey branch, he originated the system of training intelligent natives to perform surveying work previously reserved for the European establishment, thereby effecting important economies. He organised a new Indian Forest School; for some years he supervised the British students at the French Forestry School at Nancy; and he was acting as Inspector-General of Indian Forests when he was invalided home in 1890. Edinburgh was then the pioneer among British Universities in providing a scientific education in Forestry, and she gladly secured for her lectureship Colonel Bailey's unique training and ripe experience. The success of his courses on the principles and practice of forest management is attested by the number of his pupils who now hold important appointments at home and abroad. To his initiative we owe the institution of a degree in Forestry, which promises to do much to foster and encourage the scientific study of the subject."

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## NEW BOOKS.

### EUROPE.

*The Russian Year-Book for* 1912. Compiled and edited by Howard P. Kennard, M.D., assisted by Netta Peacock. London: Eyre and Spottiswoode. *Price* 10*s.* 6*d. net.*

This is only the second issue of this year-book, but the fact that a demand for such a book of reference existed is shown by the great increase in size of this edition as compared with the first. The absence of a convenient book of reference on Russian matters has indeed been greatly felt. The book opens with a frontispiece which indicates the average dates of opening and closing of naviga-

tion for Russian ports and waterways—a point of supreme geographical interest, which throws a flood of light on the conditions which prevail in the vast Russian empire. Of the various articles one of the most interesting is that on Russian peasant industries. Some 10,000,000 peasants are engaged in various forms of domestic industry; as a general rule indeed the peasant divides his time between agriculture and some form of industry, and in the more remote regions the products remain artistic and unspoilt by the contact of machine-made goods. It is indicated also that the peasant has always displayed considerable powers of organisation and co-operation. The year-book may be cordially recommended to the notice of those interested in Russia.

*Finland: The Land of a Thousand Lakes.* By Ernest Young. London: Chapman and Hall, Ltd., 1912. *Price* 7*s.* 6*d. net.*

Of late we have had some excellent books about Finland, such as Mr. MacCallum Scott's *Through Finland to St. Petersburg* (*S.G.M.*, vol. xxv. p. 43), Mr. George Renwick's *Finland To-day* (*S.G.M.*, vol. xxvii. p. 384), Miss Rosalind Travers's charming *Letters from Finland* (*S.G.M.*, vol. xxvii. p. 490), and in this interesting volume we have a fourth by Mr. Ernest Young, written more especially for travellers. Some parts of the work have already appeared in newspapers and magazines. The author has succeeded in compiling a very useful and interesting work, in which we have a succinct account of the political history of the country and of its arts—*i.e.* painting, music, architecture, and literature, as well as a pleasing account of its present conditions, natural resources, and future prospects. The writer has the eye of an artist in his descriptions of natural beauties, and he is enthusiastic, albeit discriminating, in his admiration of the character of the people. He is seen at his best in his descriptions of life on a Finnish farm and village. The book is illustrated with a number of excellent photographs.

*In the Carpathians.* By Lion Phillimore. London: Constable and Company, Ltd., 1912. *Price* 10*s.* 6*d. net.*

Our readers will remember with pleasure the interesting and instructive lecture delivered to the Society during the Christmas week of last year by Mr. Shrubsole, the subject of which was "Among the Carpathians." In the volume now before us we have an account of the Carpathians written from an entirely different point of view. It is the work of a lady who, with her husband, decided to make a summer tour along the south of the Carpathian Mountains, and apparently a cardinal feature of the tour was to be that they should avoid towns as much as possible. From Cracow, in Poland, they took train to Zakopane on the Hungarian frontier, and there provided themselves with a tent, cart and horse, and various more or less necessary requisites for a tour in camp which was to last for two months. Their route was practically eastwards along the base of the Carpathians till they came to Mount Inew, after which they proceeded south-east and south until they reached Brasso, better known as Kronstadt, where the tour really ended. In the course of their camping they came across Slovaks, Magyars, Ruthenians, Wallacks, and the ubiquitous Jew, and one of the main interests in the book is the information it gives us regarding the customs and ways of the different nationalities. The expedition was indeed singularly free from exciting adventures; not a bear, or even a wolf, created a sensation, although the party had been warned to expect them both. Incidentally we hear something of the bitter feelings among the nationalities which inhabit the Austrian empire, which one day may affect the

map of Europe. The story of the tour is very pleasingly told by Mrs. Phillimore, who shows unusual enjoyment of and capacity for roughing it in strange places, and accepting unforeseen circumstances with enviable insouciance.

*Two Thousand Miles on Foot: Walks Through Great Britain and France.* By G. W. Fox. With Portrait and 87 Illustrations by the Author. London: Walter Scott Co., 1911. *Price* 6*s.*

This book, which seems somewhat high-priced for its size, contains accounts of five walking tours made by the author at different times, illustrated by numerous sketches. The style and the author's comments on men and matters are a little artless, but as a simple account of familiar places the book is interesting enough.

*The Clarendon Geography*, vol. i. By F. D. Herbertson. Oxford: At the Clarendon Press, 1912. *Price* 3*s.*

This book is divided into three parts, of which the first deals with the principles of Geography, the second with the British islands, and the third with the continent of Europe. It is illustrated by two coloured maps on the covers, that of Europe being somewhat crude in its colouring, and a great number of useful sketch-maps and diagrams, mostly derived from the recently published Oxford Wall Maps. There are in addition a number of illustrations from photographs. The book is well printed and thoroughly modern in style. It should prove very useful as a school text-book.

## ASIA.

*Siam: A Handbook of Practical, Commercial, and Political Information.* By A. W. Graham, M.R.A.S. London: Alex. Moring, 1912. *Price* 10*s.* 6*d. net.*

This is a book for the intelligent rather than the casual reader, since it lacks that personal quality which so often lends atmosphere and charm to the few facts obtained by a tourist on a brief visit to the country. It is rather the impersonal work of an expert, beginning with the geography, history, and government of the country, and telling of its commerce and industry, its religion, art, and language. Each section is full of interest, and a mass of information is given clearly and simply, no previous knowledge of the country being required to enable one to appreciate the book. It shows us the gradual evolution of a loyal nation out of a number of semi-independent races, and we cannot but honour the wisdom and courage of the rulers who have brought this about, and are bringing a "slightly backward native state" into line with modern ideas of administration and progress.

The changes made have not all been triumphantly successful, but a fair measure of success has been attained already, and more may be expected in the near future.

The wealth of Siam lies chiefly in its forests and paddy-fields; the former are now being conserved, and the latter need but an efficient scheme of irrigation to make Siam one of the great rice-exporting countries of the East. The character of the people, who are cheerful and amenable to discipline, but neither so philosophical as the Indians nor so industrious as the Chinese, renders them peculiarly liable to exploitation, and the Chinese were for long the chief financiers. Now the State is managing its own finance, and Western competition has destroyed Chinese supremacy, though the Chinese still manage to grow wealthy on the scraps that remain.

In religion the Siamese are Buddhist, though they are far from intolerant, and recognise some Brahman priests and customs. They aim at being able to dispense with European assistance and at providing all their own officials, but the time is not yet.

*Les Royaumes des Neiges.* Par CHARLES-EUDES BONIN. Paris : Librairie Armand Colin, 1911. *Prix* 4 *fr.*

M. Bonin, the author of this interesting book, has qualified himself for his work by a residence of fifteen years in the east, and he has been the leader of two expeditions for the purposes of exploration on the Tibet and Chinese frontiers. The plan of the book is an exposition of the history and geography of the countries along the south of the Himalayas from west to east, a huge task in itself, and, as M. Bonin has confined himself to about 300 pages, the result is that we have a series of short sketches, exceedingly interesting and well worth study as giving the impressions of a well-qualified official who has studied his subject on the spot. As usual he was welcomed by the Anglo-Indian officials, and allowed and assisted to go wherever he pleased and to see whatever he liked, a permission he utilised to make an inspection of some of our North-West Frontier dispositions, *e.g.* the Khyber and Malakand passes and the Swat valley. After this we have a sketch of the conquest of Cashmire and Little Tibet and of Bhutan in which much is made of the disastrous Eden embassy in 1863. Assam with its curious collection of mixed tribes, Dufflas, Abors, Miris, Mishmis, etc., comes next under consideration, and in this connection the recent ill-fated expedition of Mr. Williamson and the punitive measures which ensued after it are effectively described. M. Bonin is quite up to date, as appears from his reference to the successful expedition of Captain Bailey, the narrative of which appeared in our issue of last March. But he makes an amusing mistake when he describes Captain Bailey as "d'une ancienne famille de fonctionnaires anglais des Indes à laquelle appartient précisément le gouverneur actuel du Bengale oriental et Assam!" After a brief but interesting sketch of the Lamasery of Samding and its abbess, the concluding chapter is devoted to the tangled skein of present Tibetan and Chinese politics. The appendices are by no means the least interesting part of the work. They deal with routes in Central Asia, the sources of the Ganges, the little-known tribe of Mossos, and ten paintings by Li Lung-Mien dating from the eleventh century and illustrative of some of the races and peoples then adjoining the Chinese Empire, *e.g.*, Manchurians, Mongolians, Persians, etc. M. Bonin has made good use of his time and opportunities of observation, and his studies and conclusions will receive, as they deserve, the grave consideration of students of archaeology, ethnography and history.

*Report on the Control of the Aborigines in Formosa.* Formosa : Bureau of Aboriginal Affairs, 1911.

Implicitly if not explicitly we have come to look upon the world as the heritage of those who can make best use of it, with the consequence that there is apt to be friction between the aborigines of any land and settlers who wish to develop its resources. This is specially the case in the island of Formosa, where the aborigines are bloodthirsty savages, occupying the little explored mountainous interior of the country, which is covered with valuable forests, while the settlers are, for the most part, industrious Chinese, more skilled in the arts of peace than of war. The various tribes of aborigines number in all some 120,000, and occupy 7000 square miles, about half the total area of the island. Under Chinese administration little was done to protect the settlers, but in 1897 the Japanese proceeded to

reinstate on a sound basis the old organisation of Aiyu-sen or Guard-lines, by means of which the savages are coaxed or compelled to give up their vicious practices and to become peaceful farmers.

Like the Roman walls in Britain, the guard-line is a base of offence and defence: inside the line safety is guaranteed, without there is a state of war. The line itself, consisting of a road and clearing strung with defensible guardhouses in telephonic communication, runs along the hills and river valleys, and is pushed forward from time to time to fresh strategic points. This forward movement may take place with or without the consent of the inhabitants of the district; in the former case the difficulties of exploration and forced labour are sufficiently trying, in the latter there are added all the dangers of a campaign. At all times service on the guard-lines is difficult and dangerous.

Education and medical aid are supplied at the superintendent stations, also trading facilities, deprivation of which often proves sufficient to bring the savages to reason. Progress though slow has been fairly satisfactory, especially in the south, where the people are more tractable, and the land less valuable.

We should have liked to learn more about the aborigines themselves than is contained within the Report, which professes to deal only with their control. In spite of a few printer's errors, the book is an excellent one: the organisation, history, and methods of the Aiyu-sen are clearly told in 42 pages, while 100 plates show the place and the people. The whole is finished off with statistical tables and diagrams and three good maps, and forms a Report which would do credit to any government.

## AFRICA.

*L'Ame d'un Peuple africain: Les Bambara, leur vie psychique, éthique, sociale, religieuse.* Par L'Abbé Jos. Henry. Avec 11 Illustrations de Texte et 24 Planches hors Texte. Bibliothèque Anthropos. Münster: Aschendorffsche Verlagsbuchhandlung, 1910. *Preis* 10 *Marks.*

This pamphlet contains a detailed account of the customs and religion of the Bambara, an agricultural people found in the vicinity of Segu, on the Upper Niger, and is intended by its author especially for missionaries and administrators, to aid them in their task of understanding the mental characteristics of the peoples with whom they have to deal. A very full account is given of the religion of the Bambara, who worship two sets of deities. They believe first in a supreme God who concerns himself but little with the affairs of humanity, and delegates power to a great number of *jinns* or subordinate beings who require to be propitiated, and can bestow benefits. In addition there are evil powers, who for the most part cannot bestow benefits, but can injure humanity. The resultant very elaborate system of beliefs and practices is carefully detailed by the author, who also gives much space to social life. The pamphlet should be of great value to anthropologists.

*The Climate of the Continent of Africa.* By Alexander Knox, B.A. (Cantab.), F.R.G.S., Member of Convocation of the University of the Cape of Good Hope, etc. etc. Cambridge: At the University Press, 1911. *Price* 21*s. net.*

Mr. Knox, whose death has recently been announced, produced in this book a volume which may fairly be regarded as an encyclopædia of the climate of Africa. In the preface he, rightly enough, states that it does not pretend to be a meteorological treatise, since it confines itself to giving the facts. Surely on that ground it is better than a treatise, for it will be the source of many treatises. Mr. Knox has with much

labour collected and systematised statistics from every available spot in Africa, and has set them forth after a logical method. Reference is facilitated not only by the convenient arrangement and grouping of countries and regions but also by an excellent index. A series of thirteen beautiful maps illustrate the annual and monthly distribution of rainfall. Notes are added on the chief vegetable products of each climatic district, and meteorological tables for the principal European capitals provide a basis for helpful comparison. In most cases the observations upon which Mr. Knox's means have been calculated extend over a sufficiently long period, so that his work is assured of remaining a standard for many years to come.

*Morocco after Twenty-Five Years.* By Dr. Robert Kerr. London : Murray and Evenden, Ltd., 1912. *Price* 10*s.* 6*d. net.*

Dr. Kerr is a medical missionary who has been working for some twenty-five years chiefly among the Jews at Rabat on the western coast of Morocco, and in the substantial volume now before us he gives us the results of his observations of the inhabitants, their government, personal habits and characteristics, religion, etc., from a missionary point of view. He refers in one passage to Mr. Donald Mackenzie, whose excellent book on *The Khalifate of the West* we reviewed in the *Scottish Geographical Magazine*, vol. xxvii. p. 329, as an authority "than whom no man has more knowledge or a wider range of experience on Moroccan affairs," and a comparison of this book and that of Mr. Mackenzie shows that Dr. Kerr confirms in almost every particular the gloomy account of Morocco given by Mr. Mackenzie. Dr. Kerr's experiences with the natives have not on the whole been regrettable, although he had to overcome no small amount of fanatical distrust and hatred ; it was in his dealings with European officials that he seems to have had his worst moments. According to Dr. Kerr the general condition of Morocco since the treaty of Algeciras is a good deal worse than it was before it. This is not the place for a discussion of the political questions incidental to the *status quo* in Morocco, but to those who are interested in that country we can recommend this book as containing much detailed information from an eye-witness deeply interested in the country and having its welfare at heart. We may add that there is an excellent map—the work of the Edinburgh Geographical Institute.

*On the Backwaters of the Nile.* By the Rev. A. L. Kitching, M.A., Late Exhibitioner of Emmanuel College, Cambridge. London : T. Fisher Unwin, 1912. *Price* 12*s.* 6*d. net.*

There is certainly no lack of writers on the anthropology of the indigenous tribes of Central Africa, but the subject is far from being exhausted, and in the volume now before us we have a substantial and important contribution from the hand of the Rev. Mr. Kitching, a medical missionary, who has been working in Uganda for some ten years. During this time he has moved about a good deal, from the slopes of Ruwenzori on the south-west to those of Mount Elgon on the east of Uganda. In this book he does not obtrude his work as a missionary, but what he does tell us of it is told in most attractive and interesting fashion, inviting comparison with the fascinating work of the late Dr. Pennell, *Among the Wild Tribes of the Afghan frontier* (*Scottish Geographical Magazine*, vol. xxv. p. 331), and not losing by the comparison. Indeed it is very obvious that Mr. Kitching possesses in no small degree the many personal accomplishments and qualifications which were the sure foundation of Dr. Pennell's success. He sympathises with and understands the semi-civilised people he is dealing with, and does not expect

too much from them: he willingly and wisely makes due allowance for their history and environment: he recognises their multiform difficulties arising from the superstitions, oppression and miseries of centuries: he sees and admits the hardships which the introduction of Christianity and settled government can scarcely fail to inflict on them. If for no other reason we would heartily recommend to our readers a perusal of this book, which will give them as comprehensive and pleasing an account of the work of a medical missionary in Uganda as Dr. Pennell's classic book does for medical missionary work on the Afghanistan frontier. But Mr. Kitching modestly claims for this work that it is only a contribution to the study of anthropology. He is, he says, merely a recorder of facts which he has observed among the numerous and widely differing tribes among whom he has worked. He has no theories or dogmas of his own to support, and he frankly admits that his observations are neither exhaustive nor complete. But so far as they go they are unbiassed and accurate, and in this consists their value. Mr. Kitching succeeded in winning the confidence of the strange tribes and races among whom he lived, from the manly and sporting Gaus to the cannibal Bagisu. His observations are minute and range over the whole field of native life, and he has made excellent use of the exceptional opportunities which his profession as a medical missionary provided him. He has collected together a number of quaint and characteristic native proverbs. We must add that this most interesting volume is profusely illustrated by excellent photographs and is equipped with a useful map.

## AMERICA.

*Confederation of the British West Indies* versus *Annexation to the United States of America.* By Louis S. Meikle, M.D., D.D.S. London: Sampson Low, Marston and Co., Ltd., 1912. *Price 5s. net*

The author characterises his book as "a political discourse on the West Indies." It gives some account of the various islands, but is chiefly concerned with the thesis that confederation of the British West Indian Colonies, with responsible government, is the only means of checking ultimate annexation to the United States of America. Apart from other objections such annexation would, it is pointed out, give rise to great difficulties with the negro population, which now occupy quite a different position from that of the coloured people in the United States.

*The Barbados Handbook.* By G. Goulburn Sinckler. London: Duckworth and Co., 1912.

This handbook is published by the order of the Legislature, and gives a detailed account of the island, with some good illustrations. The information supplied is mostly of the minute order, and the book is more for reference than for reading.

*Blanket-Stiff: A Wanderer in Canada.* By Norman Noel. London: The St Catherine Press, 1912. *Price 2s.*

This is a simple little account of the experiences of a young man of nineteen in Canada, told with all the appearance of strict truthfulness. It should be useful to those contemplating life in Canada, and others will find it an interesting picture of the far western region, where life and prospects are somewhat less rosy than the leaflets of emigration agents would have us believe.

*The Beauty, History, Romance and Mystery of the Canadian Lake Region.* By Wilfred Campbell. London: Hodder and Stoughton, n.d. *Price* 3*s.* 6*d. net.*

In this volume Dr. Campbell has set for himself a task the magnitude and difficulties of which he does not conceal. It is no less than "to give to the world in some form an account of this region and these lovely and magnificent lakes, so as to celebrate, and perchance to perpetuate in literature, not only their unique natural beauties, but also to chronicle somewhat of the prehistoric and historic tragedy and comedy, and the human vicissitudes which have been associated with this vicinity from the remotest human antiquity to the present day": and he is equally clear as to the qualifications necessary for any one who takes it in hand. "To accomplish this one must perform the task as a labour of love, and the narrator must have in his individuality a strange admixture of the poet, the romancer, the historian and the antiquary." His volume gives us ample opportunity of testing the author's qualifications under each of these heads. It commences with an Ode to Thunder Cape on Lake Superior, and we may quote the second stanza as an example of Dr. Campbell's poetry—

> "Across thy rest the wild bee's noonday humming,
> And sound of martial hosts to battle drumming,
> Are one to thee; no date knows thine incoming;
> The earliest years belong to thy life's summing:
> O Ancient Rock, thou aged Cape of Storms!"

The ode and many of the other poetical pieces in the book show that Dr. Campbell has considerable facility in rhyming; but rhyming is not poetry. His prose, however, is much better than his verse. He writes with the free eloquent fervour of an enthusiast who sincerely enjoys and loves the glorious scenery he describes. He has acquainted himself with the history of the localities, and enlivens his pages with well-told anecdotes and descriptions of many exciting and stirring events which took place among them. The historical and descriptive pages are excellent, and we must add that there is a profusion of beautiful illustrations, many of them coloured.

*Fifteen Thousand Miles by Stage: A Woman's Unique Experience during Thirty Years of Path-Finding and Pioneering from the Missouri to the Pacific, and from Alaska to Mexico.* By Carrie Adell Strahorn. New York and London: G. P. Putnam's Sons, 1911. *Price* 16*s. net.*

There is material here for a dozen books of adventure. The writer was married in 1877 to Mr. Strahorn, who had already seen much of the wild life of the West. He was with the force, part of which perished in the famous massacre of the Little Big-Horn. Within a week of marriage came the offer of the Union Pacific Railroad to make him their literary advance agent. He declined unless his bride might accompany him. The company refused permission, and though they gave way to his insistence, this record is a testimony to the soundness of their first decision. It tells, for example, of a stage journey of five days and five nights with imminent danger of attack by Indians all the way; of a village held up by cowboys, who shot out every visible light; of a fearsome electrical storm in the mountains; of a six-horse runaway, and of many other perils which few women would have faced. It is not strange that the writer twice quotes the saying of Sancho Panza, "God bless the man who first invented sleep."

The most adventurous portion includes Montana, Idaho, and that region, as two quotations will show. "Say, if you fellows ain't got no guns you better get some, for you may need 'em 'fore you strike another town o' this size." "Hotel

de Starvation, a thousand miles from hay and grain, seventy miles from wood, fifteen miles from water, and only twelve inches from h-ll." But the writer's experiences also cover New Mexico, California, Alaska, British Columbia, and distant Hawaii, and always she is racy and appreciative both of the wonders of Nature and of the company she meets. The book is written in a frank, vivid style, and we enjoy such remarks as "I was on the down end of the teeter board of spirits that day," when her husband on the first anniversary of their wedding left her to go hunting.

The illustrations, some coloured, are numerous and striking. But the book would have been the better of an index, specially of places which were first visited in the making, and afterwards when made.

*The Arctic Prairies.* By Ernest Thompson Seton. Constable and Co., Ltd., 1912. *Price* 12*s.* 6*d.*

In 1907 the author and Mr. E. A. Preble of Washington undertook a six months' canoe journey of 2000 miles to the region north of Aylmer Lake. While their chief object was to see the caribou and prove their continued abundance, they intended surveying the little-known Aylmer Lake, exploring Lake Clinton-Colder, as well as collecting natural history information and material of all kinds. All these objects were successfully accomplished, and in a very well written and instructive book one learns much of these matters. In addition others of divers interest find a place, such as an estimation of the remaining buffalo, the ebb and flow of animal life, the musk ox, and the Arctic prairies themselves. Mr. Seton has named this region the new North-West, and considers it almost a "veritable Land of Promise and New Hope."

It appears the winter does not differ materially from that of Manitoba, and as for summer conditions let the author speak for himself: "I never before saw such a realm of exquisite flowers so exquisitely displayed, and the effect at every turn throughout the land was colour, colour, colour, to as far outdo the finest autumn tints of New England as the Colorado Canyon outdoes the Horsac Gorge." And again: "In every part of the scene there are but few square feet that do not bloom with flowers and throb with life; yet this is the region called the *Barren Lands of the North.*"

Mr. Seton is an expert artist and photographer; moreover, he prefers the camera to the gun. The book is excellently illustrated, and of the photographs those of lynx, caribou, musk ox, and Arctic fox in their wild state are possibly unique. It is a great pity that the scale of the maps is so small, this being particularly noticeable in that on p. 4.

*Among the Eskimos of Labrador.* By S. K. Hutton, M.B., Ch.B. Vict., Fellow of the Royal Geographical Society. With 47 Illustrations and 2 Maps. London: Seeley, Service and Co., Limited, 1912. Demy 8vo. *Price* 16*s. net.*

The sub-title of this book—"a record of five years' close intercourse with the Eskimo tribes of Labrador"—is sufficient warrant that the author knows his subject well; and this will be realised by all who read his interesting account. It is written from the point of view of the Moravian missionaries, who have long devoted themselves to what they regard as the betterment of the natives, socially and morally. It is gratifying to note that "in all their patient preaching and teaching, the missionaries have never forgotten that the Eskimo must remain an Eskimo if he is to win his livelihood as a hunter in the frozen climate of his land; and while they have instilled habits of morality and clean living, and have weeded out habits that are bad and harmful, they have urged the people to keep closely

to their native foods and habits of life and clothing; in a word, their policy has been to make the Eskimo a better Eskimo." In spite of this aim, however, Dr. Hutton has to admit pp. 279 and 310 that a certain degeneration has taken place owing to the use of stoves, and the partial use of European food. The result of these changes is that the northern or "heathen" tribes retain in a far greater degree than their southern kindred the natural coating of fat which enables them to defy the cold of winter. The use of raw foods, of which an instructive list is given at pp. 279-282, is therefore strongly advocated by the author.

The book does not contain much ethnological information, but there is a graphic description (p. 50) of "an Eskimo, black-haired and shaggy-headed, squat and solid of figure, square-shouldered and short-necked, with small active hands and feet, perhaps a little more than five feet tall, but muscular and heavy of build; . . . a square smooth face with an oily-looking yellow skin and ruddy patches on the cheeks. His lumpy cheek-bones seemed well padded with fat; his nose was a small flat dab; and he had a pair of restless little eyes that peered out of narrow slits." Mention is also made (pp. 270 and 276) of "the short Eskimo legs." The smallest man encountered by the author was about 4 ft. 2 inches. The use of the cross-bow seems to be limited to the boys in Labrador, although it is still a hunting weapon among the men of East Greenland.

It is regrettable that the word kayak is spelt "kajak" throughout the book. This spelling, quite correct when used by German missionaries, is inexcusable in a work written in English: leading, as it does, to a mispronunciation among readers to whom the word is new.

## AUSTRALASIA.

*The Mafulu Mountain People of British New Guinea.* By Robert W. Williamson. London: Macmillan and Co., Limited, 1912. *Price* 14*s. net.*

Our readers do not need to be reminded that there is now quite a number of distinguished savants earnestly studying the ethnology and anthropology of Polynesia and Melanesia; *e.g.*, Dr. Haddon, of Cambridge University, Dr. Seligmann (*S.G.M.*, vol. xxvi. p. 657), Dr. Brown (*S.G.M.*, vol. xxvii. p. 51), and Captain Rawlings, whose excellent address on "British Exploration in Dutch New Guinea" was published in the January number of this Magazine. To their number we must now add Mr. Williamson, the author of the exceedingly interesting volume now before us. In this book he has confined himself to a study of a comparatively small and little known group of Melanesians inhabiting the hilly regions of the Mekeo district of British New Guinea, known as the Mafulu. Dr. Haddon introduces him to the public with some personal notes of unusual interest. Mr. Williamson, it seems, started life as a solicitor, and only some four years ago, *i.e.*, in the summer of 1908, began the study of the ethnology of Melanesia, in which, however, he had the exceptional good fortune of being under the guidance and direction of Dr. Haddon. Unforeseen circumstances prevented him from carrying out his intention of going to the Solomon Islands and British New Guinea till 1910, and even then he laboured under the grievous disadvantages of bad health and an injured foot and leg. Under such conditions Dr. Haddon is more than justified in saying that "the only wonder is that he was able to accomplish so large and so thorough a piece of work as he has done. . . . So far as I am aware Mr. Williamson is the first British lawyer who has gone into the field, and he has proved that legal training may be a very good preliminary discipline for ethnological investigation in the field, as it gives invaluable practice in the best methods of acquiring and sifting of evidence. A lawyer must also necessarily have a wide

knowledge of human nature and an appreciation of varied ways of thought and action. It was with such an equipment, and fortified by extensive reading in ethnology, that Mr. Williamson was prepared for his self-imposed task. Proof of his powers of observation will be found in the excellent descriptions of objects of material culture with which he has presented us." A perusal of the book enables us to endorse the warm eulogium of Dr. Haddon. In his journeyings in New Guinea and among the Mafulu Mr. Williamson had the advantage of the valuable assistance of the Bishop, Fathers, and Brothers of the Mission of the Sacred Heart, an assistance which he most cordially acknowledges. After a short introductory chapter in which he deals with the rather ill-defined boundaries of the Mafulu district and the relations of the Mafulu people to their neighbours, he plunges at once into the middle of his subject and describes their physique, craniology, dress (mostly string, feathers, and dogs' teeth!), daily life, government, ceremonies, etc., into the details of which we, for obvious reasons, cannot follow, but we congratulate him on having collected together an exceedingly interesting and compendious treasury of minute information, which cannot but prove to be of great service to all students of ethnology. It is greatly to be hoped that Mr. Williamson will be able to continue and extend the studies and observations in ethnology in which he has made so successful a commencement. We must add a word of special notice of the many excellent photographs with which the book is illustrated and also of the useful map.

## POLAR.

*The Voyage of the "Discovery."* By Captain Robert F. Scott. With Illustrations and Maps. A Reissue. In 2 Volumes. London: Smith, Elder and Co., 1912. *Price 7s. net.*

The reissue of this book in a handy and compact form at a much cheaper rate should give it a new lease of life, especially now that public attention is being again directed towards the Pole and the results of the different expeditions. The maps and illustrations appear as in the larger edition, and the book is much easier to handle, and yet has excellent print.

## GENERAL.

*Die Stellung der Pygmaenvölker in der Entwicklungsgeschichte des Menschen.* Von P. W. Schmidt. Stuttgart: Strecker und Schröder, 1910. *Preis 9 Marks 60.*

This is a detailed study of the different pygmy races found at the present time on the surface of the globe, leading to the conclusion that they are not, as has been maintained, degenerate stocks, but constitute a primitive race, with well-marked common characters. The author indeed carries his thesis a step further, for he maintains in addition that pygmies represent the oldest stage in human development known to us, and not only carry us back beyond such primitive races as the Australians and Tasmanians, but even beyond fossil man. He brings forward as arguments for their primitive nature the fact that all remain at the collecting stage, without practising any cultivation, or rearing any domestic animals; that they are permanently nomadic, making only very primitive forms of dwellings; that their tools and weapons are more primitive even than those of the men of the Old Stone Age, for they do not use stone, but only wood, shell, and bone; that they have no musical instruments, even the drum, so widely used to mark rhythm, being absent, and so on. The book concludes with an eloquent appeal

for an adequate study of these interesting and peculiar peoples, especially in the case of the Congo pygmies, still inadequately known.

*Our Weather.* By J. S. Fowler and William Mariott. The Temple Cyclopædic Primers. London: J. M. Dent and Sons, 1912. *Price* 1*s. net.*

This is a very daintily got-up little handbook, whose chief drawback is that some of the maps are so reduced as to be illegible. It will be found useful as giving a concise summary of the essentials of meteorology, and may be recommended to the notice of teachers who include this subject in their geographical course. We note that, in marked contrast to the author of the book on *Climate and Weather* in the Home University Library Series, the authors take what may be described as the conservative view of those disputed questions connected with cyclones and anticyclones with which modern meteorology is so keenly interested. There is indeed nothing in the booklet to suggest that much of the traditional meteorology is at present being thrown into the melting-pot.

*Einführung in die Wirtschaftsgeographie: Produktion, Verkehr und Handel der Erde, mit besonderer Berücksichtigung Deutschlands und der Deutschen Kolonien.* Von Dr. Ernst Friedrich. 2 Auflage. Leipzig: List u. von Pressendorf, 1911. *Preis* 2 *Marks.*

This is an attractive little pamphlet, giving a concise summary of the elements of economic geography. It is divided into nine sections, which are as follows:—(1) Nature and Man; (2) The Collecting Stage and its geographical distribution; (3) Plant cultivation—temperate zone; (4) Plant cultivation—sub-tropical and tropical zones; (5) The rearing of animals; (6) Mining; (7) Industry; (8) Land transport; (9) Water carriage and trade, and concludes with an index. In the first section we have not only a discussion of the climatic zones, but also of the influence of the human factor in land utilisation. The author points out that to the Romans, Germany, and generally Europe north of the Alps, ranked as land useless for cultivation, and that the high economic value of these regions from the point of view of cultivation is of recent date. Their value from this point of view now of course far exceeds that of the Mediterranean lands. If therefore to us the lands of the tropics seem meantime of relatively minor significance, we must not forget the possibility that they may some day acquire vast importance.

From the point of view of land utilisation the author distinguishes four grades of civilisation, whose distribution over the surface he discusses in an interesting fashion. We have first of all the Collecting Stage, developed alike in regions where plant growth is luxuriant and where it is scant, and therefore alike in the equatorial forest region, in the tropical and sub-tropical deserts, and in the frozen tundra. Next comes the "instinctive" stage of cultivation, where the cultivator is guided only by his individual notion of suitable methods. This occurs in the Sudan type of climate, in the tropical monsoon region, and in the less favourable parts of other regions. Then comes the stage when unquestioned tradition and empirical methods reign supreme. This occurs in China, in the Mediterranean region, and is widely spread elsewhere also. Finally, especially in north-western Europe and the United States of America, we have scientific agriculture, carried on with the assistance of machinery, characterised not only by the scale upon which it is carried on, but by its flexibility, and consequent power

of adaptation to varying conditions. The wider development of this type must lead to great modifications of the earth's surface.

Space does not permit us to follow in detail the author's treatment of other parts of his subject, but we have said enough to show that there is considerable freshness of treatment in his work.

*Handbook of Commercial Geography.* By George G. Chisholm. Eighth Edition. London: Longmans, Green and Co., 1911. *Price* 15*s. net.*

The chief changes in the present edition of this classic, as compared with the immediately preceding one, published in 1908, consist in the addition of some eighteen pages to the Introduction, these pages reviewing the more important developments in regard to commercial geography which have taken place since the publication of the last edition. Among the subjects discussed in these pages are the working of new coal beds in Great Britain and elsewhere; the prospects of sugar-beet cultivation in England; dry farming; the report of the Royal Commission on British waterways; tobacco-growing in Ireland; the trade of Ireland—this a subject discussed in some detail, and of great interest—and so on. All these, it will be noted, are matters of great importance to the economic geographer, who will find the brief summaries given of great value. For the rest the way in which successive editions of the book follow each other at short intervals affords a sufficient proof of its value.

*World Geography.* One volume edition. By Ralph S. Tarr and Frank M. McMurry. With many coloured Maps, and numerous Photographs. New York: The Macmillan Company, 1912. *Price* 5*s.* 6*d. net.*

This book has been prepared by its authors to obviate the need of the school-child buying two books on geography, and because they think that one comprehensive work is of much more use as a book of reference than two separate ones. Their book is highly comprehensive, and shows many excellent features, but its bulk and weight to our mind make it impossible for the school-child; no scholar should be asked to carry such a tome back and forward from school in addition to his other books.

As to the contents, while the book is generally both interesting and accurate, the treatment of the British Islands is likely to wound the national pride of prospective British scholars. Thus we are told that in these islands "the summer climate is too cool for agriculture." This is followed by the statement, without any climatic qualification, that "the British Isles are in the same latitude as Labrador," whereupon the authors go on to say that "grape culture" is not "general," and tobacco is "quite out of the question." After this jumble of partial truths, it is consoling to learn that "not all parts of these islands have a rough surface."

The book is very fully illustrated, both by good pictures and by maps, and gives a full and interesting account of the United States, in addition to much general geographical information.

*How Other People Live.* By H. Clive Barnard. Containing 60 Illustrations, 32 in colour. London: Adam and Charles Black, 1911. *Price* 1*s.* 6*d.*

This is another of Messrs. Black's school-reading books with coloured plates, the present one giving simple and attractive accounts of the daily life of various peoples. The pictures should, we think, be subjected to a more rigorous selection; that entitled "Arab Slave-traders" is quite unsuitable for a children's book.

*Der Kompass. I.* 46 *Tafeln und Verzeichnis derselben.* Von A. Schück. Hamburg: Selbstverlag des Verfassers, 1911. *Preis* 21 *Marks.*

*Alte Schiffskompasse und Kompassteile im Besitz Hamburger Staatsanstalten* (mit 11 Tafeln und 3 Abbildungen im Text). Von A. Schück. Hamburg: Selbstverlag des Verfassers, 1910. *Preis* 5 *Marks.*

These two pamphlets, with their elaborate and costly plates, represent a labour of love on the part of the author, carried on, as he tells us, through many years. The pamphlets only see the light of day now owing to the good offices of a number of public bodies and private individuals, for though the author's interest in the development of the compass is of very old standing, he has hitherto been unable to publish his results in permanent form. Of the two pamphlets named the smaller deals, as the title indicates, with the old ships' compasses in the position of the town of Hamburg, and is accompanied by descriptive text. The other book is intended by the author to form the first part of a general work on the compass, and contains only plates and their explanation, with a brief introductory note.

*The Student's Handbook of Stratigraphical Geology.* By A. J. Jukes-Browne. Second Edition. Illustrated with Maps, Diagrams, and Figures of Fossils. London: Edward Stanford, 1912. *Price* 12*s. net.*

This book has undergone considerable revision and modification since its first issue. A fuller treatment of the geology of continental Europe is now included, the sections relating to fossils have been revised, and many additional illustrations, including maps, sections, and figures of fossils have been added. In its revised form it should prove increasingly useful to students of stratigraphical geology.

*Cambridge Geographical Text-Books. Intermediate.* By A. J. Dicks, B.A., B.Sc. Cambridge: At the University Press, 1912. *Price* 3*s.*

This is the first to appear of a series of three new geographical text-books, planned to cover the whole course of geographical instruction, the present issue being intended for the middle forms of schools. It contains a number of maps, diagrams, and illustrations, the latter not always well reproduced, and not always quite relevant. The book seems reasonably accurate so far as we have tested it, and is well printed, and on the whole well arranged. It begins, however, with Mathematical Geography, which we regard as a mistake in method, and we note that the first of the series of questions supplied is—Of what value is the study of geography? This seems a return to earlier methods; we should have thought that the modern scholar would have been disposed to point out that he would be better able to answer the question *after* he had studied the subject not before. In addition to a very brief treatment of physical geography, the book gives short accounts of all the continents, and thus gives a concise account of the geography of the world. The sketch-maps are clear, and will be found very useful, and the book is pleasantly written, and likely to render the subject attractive to those who use it.

*A Geography of the World.* By B. C. Wallis, B.Sc., F.R.G.S. London: Macmillan and Co., 1911. *Price* 3*s.* 6*d.*

The author of this book opens his preface by saying that "An ideal course in geography would deal with the quantitative measurement and expression of the facts as to the geographical conditions under which man lives and works, deter-

mined in relation to that world as a unit. . . . This book is an attempt within many limitations to realise this ideal; it represents an endeavour to obtain in the realm of geographical facts a numerical statement of our knowledge." The author goes on to explain that for various reasons his numerical data are less complete than they might have been, but we think most of those who examine the book will consider them sufficiently extensive, and will regret that Mr. Wallis rates so highly the human appetite for statistics. But it would be unjust not to express admiration for a book which must, we are sure, have been produced only at the cost of very severe labour. Mr. Wallis states that he has been busy collecting material for more than two years, and we realise fully what arduous two years these must have been. The book, which is supplied with a very large number of useful sketch-maps and diagrams, should prove of great use for purposes of reference, and will doubtless be much appreciated by serious students; but we are afraid that the ordinary school pupil would speedily rebel if presented with these 372 pp. of closely printed matter with their innumerable tables and elaborate exercises.

*The True Temper of Empire: With Corollary Essays.* By Sir Charles Bruce, G.C.M.G., late Governor of Mauritius, of the Windward Islands, etc., author of *The Broad Stone of Empire.* London: Macmillan and Co., Ltd., 1912. *Price* 5*s. net.*

There is a classical and indeed Baconian flavour about these essays that must delight the mind of a reader with any pretensions to culture. And as the style is stately in a formal way and reminiscent of a well-ordered garden, so the matter is disciplined in careful sequence leading to a logical conclusion. The central idea is the best form of government for the British Empire, and the essays consider and elaborate that idea from various points of view. Sir Charles Bruce's large experience as a colonial governor eminently qualifies him to pronounce upon this subject, and his theory is necessarily worthy of all respect. His standpoint is the fullest freedom for constituent areas in fit proportion with the sovereignty of the central authority. Enough has been said to show that, unhappily, especially at the present time, certain aspects of this volume trench upon politics—a forbidden subject here—but we have no hesitation in recommending it cordially to the attention of every person with a thoughtful mind.

*The Statesman's Year-Book*, 1912. Edited by J. Scott Keltie, LL.D. London: Macmillan and Co., 1912. *Price* 10*s.* 6*d. net.*

This annual has as usual been revised and brought up to date, and contains additional articles dealing with the various important events of the past year, as well as a series of interesting maps. Among the latter special mention may be made of those illustrating the results of the recent censuses in India and the United States, which are of great value and importance.

*The Children's World.* By S. Shenessey. London: Adam and Charles Black, 1912. *Price* 1*s.* 6*d.*

This is another of Messrs. Black's colour books, the present one being intended for advanced kindergarten and Standard I. children. It is accompanied by a series of suggestions to teachers, which include handwork and songs to be used in connection with the reading lesson. The book contains a good deal of information about the peoples of the world, and could be employed to serve as an introduction to geography.

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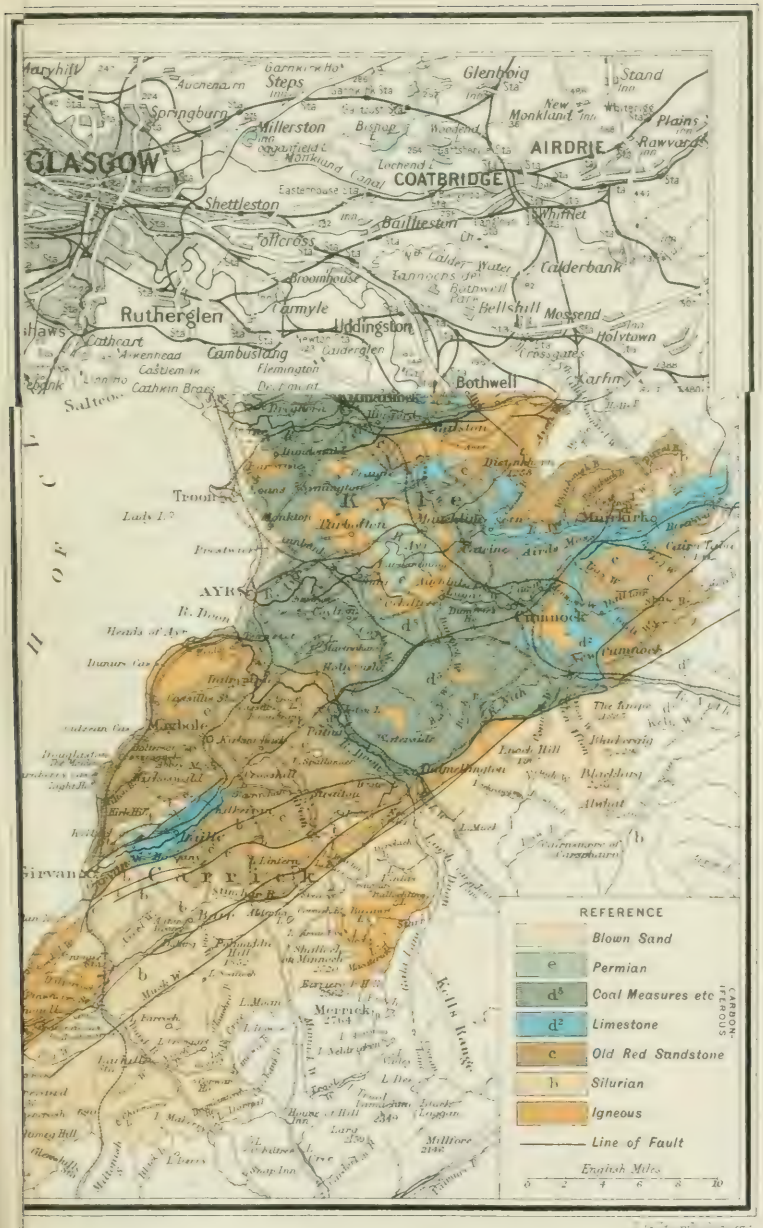
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# MAP OF AYRSHIRE

## OROGRAPHICAL, COMMUNICATIONS, AND GEOLOGICAL

ILLUSTRATING Mr T M STEVEN'S PAPER

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

# SOME PHYSICAL AND BIOLOGICAL FEATURES OF NORTH AMERICAN DESERTS.[1]

By Daniel Trembly Macdougal, Ph.D., LL.D., Director, Department of Botanical Research, Carnegie Institution of Washington.

The Desert Laboratory of the Carnegie Institution of Washington was established in 1903, at Tucson, Arizona, upon the recommendation of a number of botanists that facilities be provided for the study of the general problems of plant physiology, using the specialised forms of vegetation peculiar to arid regions. The earlier researches carried on at this laboratory by Dr. Cannon, Professors Livingston, Lloyd, Spalding, and myself, opened up such possibilities of advance in investigation in general botany, that the institution organised a Department of Botanical Research, which was to have its centre of activity at the Desert Laboratory,[2] but which would be concerned with any phase of desert work for which opportunities for new results were offered. In addition to a number of members of a regular staff, the organisation was amended later to permit the appointment of collaborators and research associates, who might act in connection with the department for limited periods.

Deserts were taken to be the expression of definite physical complexes, made up of factors or agencies affecting living organisms, and resulting in certain features of surface geology: it seemed important, therefore, to make some definite estimation of the environic factors, and to analyse their separate effects upon plants and upon the soil. In carrying out this idea a group of workers has been organised, the separate members

[1] An address delivered before the Society in Edinburgh on April 3, 1912.

[2] For some account of this Laboratory, with figures, see *S.G.M.*, xx. p. 605, and xxvi. p. 9.—Ed. *S.G.M.*

of which are carrying out researches on a group of related problems in phytochemistry, soil-physics, evaporation, transpiration: the composition of the sap, and the amount and variations of the water-balance of desert plants: the environic re-actions of species interchanged between maritime and alpine, desert and maritime, and desert and humid localities; the origin and fate of plant populations in well-defined regions; the distributional movements of desert plants: the re-vegetation of submerged desert areas, and various aspects of possible fluctuations in climate during recent geological time. It is unnecessary to say that such activities are not usually conducted under botanical auspices, but in this, as in all scientific effort, the results of highest value are to be obtained by the co-operative effort of workers in correlated branches.

The possible importance of investigations in the phenomena of the desert may be realised when it is considered that the arid regions of North America cover 2,000,000 square miles, that half of Africa is arid, and that if the deserts of the world were brought together, their total area would be as much as one-fifth that of the land surface of the globe, or about equal to the extent of Africa. Relative aridity has been a dominant factor in the evolutionary development of the higher plants, while the influence of deserts upon the beginnings of human civilisation, and on the shaping of cultures and moulding of religions, is a subject much too vast to be discussed in this lecture. Earlier, deserts were inhabited and used by nomads only, but now everywhere in America, Asia, Australia, and Africa, effort is being made by colonisation and occupation to convert the dry places of the world to the uses of modern civilised man.

Although the extent and location of the principal deserts are well known, yet it is not easy to state the exact conditions which operate together to make a desert. Amount of rainfall alone may not be taken as a reliable index, since the final effect of any given amount of precipitation is influenced by latitude and wind, and varies with the seasonal distribution of the rains. The possible evaporation is equally insufficient to determine the degree of aridity of a region. It was proposed by Angot, in 1886, to use the ratio between the maximum and minimum rainfall in any region as a test of its agricultural possibilities, and when the greatest amount received in any year was two and a half or three times the minimum, the limit of agricultural usefulness was presupposed. This ratio is likewise not a safe guide when taken alone, since the disproportion in annual rainfall in some places in the moist tropics is very great. Some investigations now being carried out in the Desert Laboratory by Dr. Shreve and Professor Livingston seem to indicate that the seasonal curve of evaporating power of the air and of the soil-moisture have great determinative value. While we have not yet arrived at a stage where we are prepared to write the equation of the desert, yet it may be said, with some degree of certainty, that disproportion between the annual maximum and minimum rainfall: disproportion between the total amount of rainfall and the total evaporating capacity of the air: and disproportion between the evaporating power of the air and the supply of soil-moisture, will be the important factors

in the set of conditions which result in the biological, climatic, and geological phenomena so obviously characteristic of arid regions.

It has been found that a plant needs to take up and use about 300 to 600 lbs. of water to produce 1 lb. of dry material in moist temperate latitudes, while in the agricultural operations of the warm arid parts of South-Western America, three times this amount of water is needed in even the most carefully guarded systems of irrigation. These figures apply to closely-grown crop plants, such as wheat and barley. When the isolated habit of plants native to deserts is considered, and it is known that a much greater proportion of the rainfall is evaporated from the soil, it soon becomes evident that the small amount of plant growth is a direct result of the fact that as much as 10,000 to 25,000 lbs. of the limited precipitation may be necessary to produce a single pound of dry material. The operation of "dry-farming," as practised in America, offers some points of interest in this connection. To carry out this kind of cultivation, two or three times as much land is necessary as would be sown in any one season. If a crop is to be grown without irrigation in dry soil, it is obviously necessary to increase the amount of moisture in the soil by other methods. To accomplish this, the surface is ploughed or broken up, so that the rainfall may penetrate deeply and quickly when it does come. After a rain, the surface is then finely pulverised by various special tools, so that a dry "dust mulch" covers the surface, and the capillary columns which would bring the water to the surface are broken. The process is repeated after every rainfall, until tests show that the soil contains enough water to mature a crop. This may require a year or longer. After the seeds are sown, the dust mulch must be maintained as perfectly as possible, to conserve the supply of water. After the crop is harvested, the process is repeated to make the land ready for another sowing. This method has not yet been successfully used in America in regions in which the annual rainfall is less than 15 to 18 inches, although it is reported to be practicable in Australia with a smaller amount.

North American deserts include one region, between the mountain ridges of the Californias and the Pacific ocean, in which the annual rainfall may be as much as 18 inches—but this is all received in the cooler winter season, consequently, the soil becomes very dry in midsummer, and wind erosion is very marked. It is in this region that such profitable results follow the use of the streams of the mountains for irrigation of fields and groves of citrus and pomaceous fruits. To the eastward of the Sierra Nevada lie a series of great basins, some of which are so depressed as to have their bottoms below sea-level. The rainfall is very limited, and, furthermore, is irregularly distributed throughout the year, while the amount of precipitation in some years may be not more than one-twelfth of the maximum. These basins include the famous Death Valley, Mohave Basin, and Salton Basin, while to the northward and eastward lie the great basins in Utah and Nevada, which were formerly occupied by the ancient Lakes Lahontain and Bonneville. These sunken basins include the most arid portions of the continent, and as the temperature sometimes reaches 128° F. and

the rainfall varies between half and six inches, the deserticulous effects are very marked.

The greater part of the arid area of North America, however, consists of trough-like valleys, enclosed by detrital slopes leading down from the mountains, which are so much worn in some instances as to be completely buried, although some rise as high as 6000 to 9000 feet above sea-level. Most of this region is characterised by two rainfall periods, the maximum of the one coming in the summer, and the other in winter, a fact which accounts for the complexity of the flora, which shows as many species per square mile as the densest tropical jungle, although the number of individuals is very small by comparison.

It will be of interest to examine the details of some of these deserts with greater minuteness, and we naturally begin with "The Great American Desert" lying in Utah, about which so much has been written, since it lies on the main highway across the continent, and was a very serious matter to the traveller by wagons sixty years ago, when settlers poured into California from the eastward. The principal vegetation is the sage-brush, or *Artemisia tridentata*, which grows densely over large areas. In regions occupied by the Great Salt Lake in recent time, and in other places also, the ground may support only a scanty vegetation, showing a surface of hard clay, or a loose layer of wind-carried soil, which may have a high salt content, and hence would be termed alkaline, or saline.

The Salton Basin has been the object of some special studies by the members of the staff and co-operators of the Desert Laboratory, and some of the results obtained are of great interest. This basin lies in Southern California and partly in Mexico, and has a total area of about 5000 square miles, of which 2200 square miles are below mean tide-level, the lowermost part being 284 feet below sea-level. I was so fortunate as to have visited the bottom of this basin in 1903, and made an examination of the lower part, in which a great salt deposit had been formed, and the vegetation was chiefly of the halophytic types of the sea-shore capable of existence in such places. The delta of the Colorado River forms the south-eastern wall of the basin, and the presence of many old beach and strand lines show that the waters of the river have filled the basin to varying depths on many different occasions. The faulty construction of an irrigation canal on the Mexican side of the international boundary, allowed the waters of the river to flow into the basin during 1904-1906, making a lake with an area of 500 square miles, and a maximum depth of 85 feet, which of course completely destroyed the desert vegetation of the submerged area. The break in the canal was brought under control in 1906, and as there was every prospect that the lake would again disappear, as it had many times before, plans were made for a study of the return of the desert species to the emersed area. In this work it was realised that the re-vegetation of the tops of the hills, which appeared as sterilized islands, would offer some exceptional opportunities for the study of the dissemination of plants, while it would be possible to get some facts bearing upon the fossilising effects of saline waters upon plant tissues. It should be mentioned that

the fresh waters of the river took up so much salt from the soil of the basin that the total saline content of the water of the lake was one-fourth of one per cent. at first, the chief salt being sodium chloride. Attention was also paid to the formation of beach terraces on the steeper slopes as the waters of the lake receded, since conditions had been set up in old terraces of this kind whereby bands of vegetation were formed that maintained their integrity for hundreds of years.

The islands, or emersed hill-tops, were seen to be sown with the seeds which were floated on the surface of the lake, and some living branches were also cast ashore on them. From seeds there came *Sesuvium*, *Allenrolfea*, *Suæda*, *Rumex*, *Pluchea*, and another composite, a grass and a sedge, while *Typha* and *Prosopis* arrived as floating branches, or root-clumps. In no instance could it be shown that a plant was transported to an island by the exclusive agency of the wind, although the seeds of many species were blown on to the surface of the water in this manner. Much attention was also directed to detecting the probable action of birds in the bringing of plants to the islands, and although gulls, cormorants, and ducks resorted to these places in great numbers, yet in only one instance was it allowable to suppose that a plant, with burr-like seeds, had been carried to a place slightly above the high-water line by one of these birds. It became distinctly noticeable early in the present year, that species which were floated in previous seasons to the beaches and on to the newly appearing islands, no longer appeared in the annual sowings. The only explanation offering itself is, that the saline content of the water of the lake had increased to 72 to 100 per cent., making a concentration probably fatal to the seeds—although this has not yet been tested experimentally. The total evaporation from the surface of the lake is about 80 inches yearly, yet so much fresh water from precipitation and from irrigation systems flows into it, that the actual fall is about 40 inches, and the level is now about 18 feet below that of 1906. It is proposed to continue our studies on various phenomena of the lake, including the soils of the emersed strands, for several years.

The Otero Basin in central New Mexico (United States) has also many features of interest in the present discussion. Geologically, this basin has been formed by a dropped block, and it is about eighty miles long and twenty-five miles wide. The drainage from the enclosing slopes has made a large lake in times past, the old beaches of which are still visible, but now the rainfall, which is less than 25 cm. annually, results only in temporary pools and lakes, which show a bare bed incrusted with salts during the dry seasons. The principal constituent of these is calcium sulphate, which forms coarse crystals on the playas, or lake beds: these are fractured and powdered by the action of the sun and wind, and are carried to the north-eastward into a great system of beautiful dunes of snowy whiteness. These dunes contain much moisture, and support much vegetation, which does not seem to be much affected by its growth in this unusual substratum. It is notable that neither here, nor in the Salton Basin, are more than a half-dozen species found which might be termed endemic, although the environment is highly specialised as to its edaphic characters.

There now remains to be considered the more general desert landscape, that in which the deep valleys between mountains have been filled by material eroded from the cliffs and mountain-sides. The most striking features of such regions are the wind erosion effects, and the abruptness with which the steep slopes of the mountain rise like walls from the gentler slopes of detrital material. In some instances the mountains rise to such height that their moist summits support a vegetation of a distinctly mesophytic character, in which case they form biological islands in the desert. In any case the rainfalls on the higher parts of the mountains, where the condensation is, of course, always greater than in the adjacent lowlands, collect in the canyons and rush down the steep gradients as torrential streams, carrying an immense quantity of material out into long arched slopes leading down from the mountains. These slopes may be from one to eighty miles long, and are known to our Mexican neighbours as *bajadas*, a term which has been adopted to designate them by the workers at the Desert Laboratory, after the proposal of Professor Tolman. In times of great precipitation the stream may flow down the entire length of the bajada which it has formed, and reach the bottoms of the valleys, where the water comes to rest, depositing level floors of finely divided material, in the form of playas. At other times the water sinks into the loose material, and may flow in considerable volume beneath the surface. If a rock or clay stratum is encountered, the flow is brought to the surface, making pools or "tanks." The agricultural development of country of this character entails bringing the underflow to the surface by wells, or by sinking concrete dikes in the bajadas. It is needless to say that the physical characters of the bajadas and playas exercise a very important effect on the distribution of the vegetation.

In addition to the mesophytic vegetation which may occur on the mountain tops, it is important to note that many species belonging to the well-water regions of the north temperate zone are to be found along the margins of streams and in flood-plains, constituting in the vicinity of the Desert Laboratory as much as forty or fifty per cent. of the entire flora. If the species which inhabit the dry slopes are examined, it will be found that they may be roughly divided into two classes. In one the shoots are reduced, the branches are short, or are reduced to the shape of short spines, the leaves are extremely small, and the parts exposed to the air are waterproofed in such a manner as to reduce the rate of water loss, while the root-systems are enormously developed, and occupy a mass of soil that has the general form of a hemispherical basin sunk in the ground. The most striking feature of such forms, however, is one not visible to the eye; this is the high concentration of the sap, which was beautifully demonstrated by Professor Fitting in his notable work on the plants of the Sahara at Biskra. Here he found that the sap of some of these spinose forms was capable of setting up a pressure of over a hundred atmospheres. These plants seem capable of absorbing water from soils containing very small proportions of moisture, and in this connection it may be stated that they are very difficult to transplant; the root-system seems to be very delicately adjusted to the

high-pressure absorbing organs and to the soil-particles, around which the film of hygroscopic water is very thin, and this adjustment is not easily made. With regard to the origination of these forms, it is to be pointed out that when species requiring much moisture are grown under arid conditions, shoots and leaves are formed which suggest the changes necessary to produce the spinose forms of the desert.

The second type of plant peculiar to deserts is the succulent, as exemplified by the Cactaceae. The evolutionary development of these forms may be taken to include all the changes necessary for the spinose forms, and in addition, to include still more serious departures from the normal type of land plants. In this type the branches may be entirely lacking, the leaves may appear only as rudiments quickly cast off, and the entire shoot may have the form of a simple upright, cylindrical or globular body. The root-systems of such plants lie immediately beneath the surface of the soil, and extend horizontally over a comparatively large area. By this arrangement, the wetting of the soil by rains is followed by the formation of innumerable rootlets and root-hairs, which rapidly absorb water from the moist soil, and a comparatively large quantity may be taken up in a short time. When the rains cease, the soil dries out, and then the finer absorbing rootlets die, and the succulent stands inert, its roots serving as anchors only until the beginning of the next period of humidity. The sap of such plants differs widely in its composition from that of the spinose forms, as its concentration in various succulents is such that it would not set up a pressure of more than three to twelve atmospheres. The actual amount present, however, is very large: thus, an individual of the tree cactus (*Carnegiea gigantea*, or *Cereus giganteus*) may hold as much as 500 to 1000 gallons. The juice of one of these succulents, *Echinocactus wislizeni*, in the Arizona deserts is so low in mineral content that it may be used as a substitute for water by the traveller, and it is possible to obtain a quart of the cool fluid from the crushed pulp in a few minutes, as I have often demonstrated.

Man and the horse are among the animals least capable of enduring the thirst of the desert. A man requires ten to sixteen pints per day, in the drier season, although he may use less for two or three days at a time: travellers have endured twenty-four hours in the desert without water, but a longer deprivation may produce dementia and hallucinations, ending in death. The water found in desert sources often contains much dissolved matter, and our field experience shows that while a mineral content of $\frac{1}{4}$ per cent. may be used for some time, the limit as regards human consumption is reached at 1 to 3 per cent., where the great amounts taken in with the quantity of water necessary to quench thirst become dangerous.

The horse may use more concentrated solutions, and it requires eight or ten times as much per diem as a man, although it may go two or three days without a drink. The water relations of the wild animals of the desert is a subject which has not been systematically studied. It is known, however, that such animals as deer, peccary, mountain sheep, and many rodents, thrive in localities where water is not procurable, and

their sole supply of moisture must be derived from the plants used as food. Some animals live almost wholly on dry seeds and tissues containing not more than 10 or 15 per cent. of water.

The field work of the Desert Laboratory is carried on by pack trains of horses and mules, by wagons, and recently we have been able to traverse many hundreds of miles of desert in automobiles, carrying instruments, food and water. The south-western deserts of America have been crossed by aeroplanes in 1911, and the military operators in North Africa have demonstrated that this machine is now available for reaching places otherwise inaccessible.

The chief purpose of the present paper has been to point out the extent of the desert areas of the world, and to show some of the physical and biological conditions which prevail in arid regions. A closer study of these will doubtless yield results of value in the general physiology of plants, and in the environic relations of organisms in general.

In addition to the general scientific advance made possible, the knowledge gained should be directly useful in the occupation and colonisation of arid regions now being attempted in many parts of the world.

## A VISIT TO PATAGONIA.[1]

By W. G. Rae Smith.

*(With Illustrations.)*

*General Character.*—Patagonia may be taken as that part of South America situated south of the Rio Negro and the Chilian Province of Valdivia. Of the total area of 322,550 square miles, slightly more than a twentieth part is insular, the remainder forming part of the Continent of South America. West of the Andes lie rugged islands separated from the mainland by channels and fjords formed by the combined action of the waves, winds and glaciers. The chief groups are Chiloe, the Chonos Islands, Wellington Island, Hanover Island and the Madre de Dios and Queen Adelaide Archipelagoes, the last giving protection to steamers for miles on their way along the coast. On the south, Patagonia is bounded for almost four hundred miles by the Straits of Magellan, while on the east, the Atlantic Ocean forms the boundary. The eastern coast presents great contrasts to the west and south, for off it hardly an island is to be found, and the shores are low-lying and even, with few indentations, with the result that good ports are scarce.

[1] The following paper is the result of a visit paid by the author and a companion to the country in 1909. Ship was taken to Punta Arenas, at which town riding and pack horses were obtained for the journey northward. The route followed was *via* Laguna Blanca, the upper waters of the Gallegos, Lakes Argentino, Viedma and Tar to the Chico; thence to Lake Buenos Ayres, from which an eastward route was taken by the rivers Fenix and Deseado to Comodoro Rivadavia on the shores of the gulf of San Jorge.

Discovered by Magellan, who wintered near San Julian in 1520, while engaged in his famous voyage of circumnavigation, its coasts were visited and made known by several Spanish explorers, the chief being Camargo (1539), Ladelleras (1557), and Hurtado de Mendoza (1558), who visited the west coast, while Gamboa visited the east. The last named founded the settlements of Nombre de Dios and Port Felipe, or Port Famine as it was afterwards called. Drake touched at several places in 1557, and in 1587 the country round Deseado was explored by John Davis. This part was again visited by Sir Charles Narborough in 1669, who went as far as to take possession of the country in the name of Charles II. In the eighteenth century, Byron, in 1764, and

One of the Patagonian lagoons.

Bougainville added to our knowledge of the coastline, but it was not till 1832, owing to the voyage of the *Beagle* under Fitzroy, with Darwin on board, that anything was generally known of the country. In the seventies and early eighties of last century, the travels of Musters, Rogers, Lista and Moreno added greatly to our knowledge of the interior, and, later, the Boundary Commission under Colonel Holdich surveyed a good deal of previously unknown land.

From the Atlantic the land rises in a series of terraces, on an average 300 feet each time, and the surface is mostly covered with a Tertiary shingle of marine origin, usually considered to be of Miocene date. Beneath the shingle, which is somewhere about 200 feet deep, one finds an infusorial chalk descending another 800 feet. As one approaches the Andes, porphyry and granite occur in increasing quantities, and huge plugs of lava and basalt are found.

The chief characteristic of the surface to be noted is the number of more or less dry lakes or lagoons found in hollows of the ground. These often contain deposits of Epsom or common salt, and the traveller has to be careful as to the water he drinks.

On the east coast, most of the rivers rise on the slopes of the Andes, and, unless they previously dry up, flow into the Atlantic Ocean. On the north, the Rio Negro is formed by the confluence of the Neuquen and the Limay, the latter draining Lago Nahuelhuapi. South of this are two depressions, now dry, which at one time must have drained Lago Nahuelhuapi and the numerous small lakes lying round it.

Then comes the Chabut river, rising a few miles south of Lago

On the banks of the Deseado.

Nahuelhuapi in most beautiful country, where wild strawberries (*Fragaria chilensis*) abound. It is joined by a few tributaries, and flows into the sea a few miles south of Gulfo Nuevo. About seventy-five miles from its mouth it receives the Rio Senguer or Chico, which previous to 1896 drained Lakes Musters and Colhuapi, but these lakes are now in the process of drying up, and there is no outflow. The upper Senguer is the overflow of Lago Plata and Lago Fontana, and joins the Mayo, Verde, Chalia and Genguel, before reaching the lakes.

Rio Deseado, which in the maps of the seventeenth century is shown as draining Lago Buenos Ayres, now rises together with its tributary the Fenix to the north of this lake, and is a comparatively insignificant stream—usually being nothing but a succession of dry pools or a morass. (See illustrations, above and on p. 471.) The also

semi-dry Rio St. Denis, Arroyo de Bajas and Arroyo Salado flow into the Atlantic before Santa Cruz Bay is reached, but they are small and scarcely deserve the name of rivers. Into this bay the Chico, which is the outflow of Lago Belgrano, flows after joining the Chalia, a former outlet of Lago San Martin, which now drains into the Pacific. The Santa Cruz, which is the outflow of Lago Argentina, and, through it and the Rio Leone also of Lago Viedma, also disembouches here. Further south are the Rios Cayle and Gallegos, the latter of which, especially, is very turbulent in early spring, when the snows melt on the slopes of the Andes. Between most of those rivers there lie plateaux or mesetas of hard basaltic rock, and, save near the coast and south of the Santa Cruz river, this renders the bulk of the land utterly unsuited for cultivation, or even for grazing.

The rivers running into the Pacific are short and rapid and, in the south, many are nothing but glaciers running down to the water's edge.

Further north the most notable are Rio Baker, draining Lago Buenos Ayres, with its tributary Las Heras which drains Lago Pueyrredon, and Rios Aysen and San Martin.

The number of lakes lying to the east of the Andes and having their outflow to the Pacific by rivers cutting the Cordillera at right angles is remarkable, and has led to many disputes between the Government of Argentine and Chili. The matter was finally settled by the arbitration of King Edward VII., who dispatched a commission to investigate the region on the spot and decide on the boundary. This was eventually done, both sides giving way on one or other of the disputed points.

A good story is told of how a man living near the Eisen managed to get his farm located in the Argentine. He ran a telegraph line from his house over the top of a hill near, and there it stopped. Then when the officer in charge came along, he offered to send a telegram for him to Buenos Ayres. The offer being accepted, he dispatched a man on horseback as fast as he could gallop to the nearest telegraph office, and an answer was obtained in two and a half days. He attributed the delay to a breakdown, and the officer seeing that this farm was apparently so closely linked to the Argentine gave his decision accordingly.

*Punta Arenas.*—Towards their western end the Straits of Magellan are majestic in the extreme, the high hills on either side sloping sheer to the water's edge, and in winter when covered with snow the sight is not one to be easily forgotten. At the eastern end, low bare sand-hills, covered with short grass, slope gradually down towards the shore. Then as one approaches the centre of the straits, forests begin on the north side, and in the distance one can see tier after tier of forest-clad hills rising one above the other. Finally, on rounding a corner Punta Arenas appears to view. At first sight the town is distinctly disappointing, for, lying on the shores of a wide open bay, one only sees a collection of buildings made of wood and corrugated iron.

The roadstead is open, and steamers lie about two miles off the

shore, and there they transfer their cargo to lighters which finally discharge at one or other of the four small wooden jetties.

The town is regularly laid out in what might, by courtesy, be termed streets. Cutting each other at right angles, those so-called streets run straight up and down utterly regardless of the slope of the ground.

According to the approved South American plan, the Plaza in the centre of the town is well laid out with a bandstand in the centre, surrounded by four small fountains, and the spaces between the paved walks is sown with rye grass. A few trees surround the square, but owing to the bleak climate they have not succeeded well. Round the square are the houses of the well-to-do citizens. The streets are cobble-paved, with open gutters, and for the most part are very rough, the sudden descent from pavement to street necessitating the greatest care.

The chief business is the shipping of wool, and Punta Arenas is the chief port of entry for southern Patagonia. Owing to free trade goods are all very cheap, and large quantities of stores, etc., are landed here, either for the use of settlers in the surrounding country or to be transhipped to smaller boats, and carried to the ports of Tierra del Fuego or the smaller towns of the Patagonian coast.

Besides the shipping business a number of small industries are carried on in the town. There is a brewery which produces excellent lager beer, and also a stronger variety. There is an iron foundry which does a fair amount of business in making and repairing small machines, etc., but all heavy machinery has to be imported from Europe or North America. A splendid water system has recently been introduced to supply the town with water.

Punta Arenas was originally founded by the Chilian Government in 1851 as a convict settlement, and for many years was only visited by sealers or chance passing vessels. The only event of interest in its early history was a revolt of the convicts who, in 1878, broke loose one night, murdering and robbing their gaolers and the free settlers. The Governor managed to escape with his wife and family, and, after hiding them in the neighbouring woods, he contrived to procure a horse, and, though badly wounded in the legs, proceeded some ten leagues to where a French ship was lying and secured assistance, having had to swim several rivers on the way. A British ship steamed into the bay, and not knowing anything was wrong was very nearly captured by the convicts, but a Chilian sloop entering at the same time managed to give warning of what had occurred, and the convicts were prevented doing further mischief. The Chilian boat turned its guns on the town, and the revolt was at an end. Most of the convicts, however, fled into the *camp*,[1] but were in time captured, after having suffered great hardships. A few managed to proceed across country to Gallegos in Argentine territory, but were for the most part arrested

[1] English for *En el campo*, used throughout South America to distinguish the country as apart from a town.

there and handed over to the Chilian authorities. They are said to have suffered severely on their 200 miles' trek, and it is hinted that they even resorted to cannibalism.

Later, settlers gradually began to drift to this part from the Falkland Islands and the northern parts of the Argentine, and about 1890 quite an influx took place. On the mainland there were leagues and leagues of fertile ground to be occupied, the Indian inhabitants having mostly died out, but in Tierra del Fuego, the Indians, although of a lower race, were still numerous and did not welcome the white man, whose flocks and herds occupied the land which from time immemorial had been their hunting-grounds. The guanaco and other game thus driven off took refuge in the more inaccessible mountain ranges in the south of the island—often in territory occupied by hostile tribes.

The poor Fuegians therefore, making even at best of times only a poor living, were driven to desperation by the prospect of starvation, and what was more natural than to kill the sheep for food! The settlers retaliated, and the Fuegians were treated more as wild animals than as human beings, generally being shot on sight. They are now practically extinct in the northern part of Tierra del Fuego, although numbers are still to be found in the south and among the islands to the west.

The Onas, the predominating tribe in the south, are very fierce and warlike and are seldom interfered with, and the Fuegians of the Sounds are hardy in the extreme. Even in this bleak climate they eke out a miserable living, eating for the most part shellfish and fish, and using very little, if any, clothing.

However, the days of slaughter are past, and in Tierra del Fuego countless numbers of sheep are pastured, owned chiefly by several large companies.

Punta Arenas also boasts a small coal-mine. This has recently been bought by an Englishman, and good results are expected. Previously the native owner had a great surplus of coal in the summer months and sold the coal for what it would fetch, while in winter the small railway running to the mine, about five miles from the town, was constantly blocked both by the heavy traffic and by snow, and the coal in consequence was exceedingly dear, as the supply could never keep up with the demand. The coal resembles lignite, and does very well for household purposes, although it is not satisfactory from other points of view.

Freezing works were erected a year or two ago a few miles from the town, and large numbers of sheep and lambs are, after slaughtering, frozen and stored in cold air until a sufficient number of carcasses is collected, when they are exported.

A proposal was brought forward a few years ago to start similar works at Ultima Esperanza—an inlet on the west coast, about 200 miles distant by land—but the current in some of the sounds was thought to be too swift to allow of access for a large steamer, and the idea has been given up for the present. Instead, a grasseria or boiling-down factory has been put up, and surplus stock are disposed off in this way. The sheep are skinned and put into large tanks with water, and,

after boiling and reboiling for several hours, the fat is extracted and refined.

Numbers of small craft ply between Punta Arenas and the smaller ports on the mainland and Tierra del Fuego, while every fortnight the Pacific Steam Navigation Company's mail and intermediate boats call on their way to the west coast ports and on their return. A German company also runs frequent boats from Buenos Ayres, as well as an Uruguayan service.

The priests of the monastery have started a small museum with specimens of the animal and vegetable life and the minerals found in the district, the most memorable exhibit being a small portion of the skin of the giant sloth, found in a cave near Ultima Esperanza.

The population of the town has decreased greatly in the last few years, and now numbers about 10,000, this decrease being due to the slump in gold-mining. The majority of the population are, as might be expected, Chilenos; while of the foreign element Germans and British are practically equal in number.

*Government.*—The Argentine portion of Patagonia is much larger than the Chilian, and comprises the land lying to the east of the Andes, north of latitude 52° south, and of a line drawn from the intersection of this parallel with longitude 70° west to Dungeness Point. The eastern portion of Tierra del Fuego also belongs to the Argentine.

Chilian Patagonia is divided into the three territories of Llanquihue, Chiloe, and Magallanes. Llanquihue is little settled save in the north, where Port Montt is situated, this town being connected with the rest of Chili by railway. Chiloe, which comprises the Island of Chiloe and a large number of islands to the south, is densely wooded, and sealing is carried on in a small way. The inhabitants of these two territories are practically all Chilenos, with more or less Araucanian Indian blood in their veins. The territory of Magallanes, which is the most important of the three, extends from Rio Baker to the Straits of Magellan, and includes the Chilian portion of Tierra del Fuego and the adjoining islands. The capital is Punta Arenas, which is also by far the most important town in Patagonia.

These three territories do not rank as provinces of Chili, but are governed as colonies by officials deputed for the purpose by the President. The inhabitants have no voting powers whatsoever, but the laws on the whole are the same as those existing in the north, the chief exception being that here, as likewise in Argentine Patagonia, no custom duties are levied—a system of free trade being followed. This was a concession made to the early colonists to induce them to take up and farm land in this uninviting country, but it is liable to be repealed at any time, and signs are not wanting that the chancellors of both the Argentine and Chilian exchequers look with envy at the free entry of goods from which considerable revenue might be raised.

So far it has largely been due to the want of harmony between the two governments that free trade has flourished so long, for if one country adopted a high tariff and the other not, the whole of the amount of duty collected, and much more, would be spent in guarding the long, unsettled boundary.

No great desire for self government by the reconstitution of the territories into provinces is apparent, and indeed Magallanes is the only one which has sufficient population, and of this by far the most influential, if not the largest, portion is foreign to the country. Many foreigners have been appointed commissarios or magistrates in the country districts, and the laws are much more strictly upheld than in the neighbouring Argentine territory.

Argentine Patagonia is divided into four territories, namely :—Santa Cruz, Chubut, Rio Negro and Neuquen, although the last named cannot perhaps be properly classed as part of Patagonia.

Lying in the triangle formed by the Limay and Neuquen rivers and the Andes, Neuquen contains an area of 80,000 square miles, with a population in 1900 of some 1200 people. This has probably increased of late years, as much land has been taken up for pastoral purposes and a good deal of alluvial gold mining has been done. The chief town is Chosmalal, and silver, copper and lignite are found near and worked in a small way. Rio Negro territory, extending from the river of that name to latitude 42° south, has an area of 44,000 square miles, with a population of some 7000. Save on the banks of the Rio Negro and in the country surrounding Lago Nahuelhuapi, the land is arid and dry and of little use for settlement. Chubut, which lies between latitudes 42 and 46 south, contains 95,000 square miles, and its colonisation is largely due to the Welsh settlers who originally took up land on the Chubut River. Rawson is the seat of government, and here there is a strong foreign element, but the commissarios and alcaldes are all native-born Argentines. Madryn and Comodoro Rivadavia are the chief ports, and nearly all the commerce of the interior passes through one or other of these towns. Although Chubut is essentially a pastoral country, a little gold has been found in the rivers at the base of the Andes. Santa Cruz, with 106,000 square miles, extends from Chubut to the Chilian border, and is but sparsely populated, having some 2000 people (mostly men) in 1906. Life and property are not so safe as in the Chilian territories, and the commissarios must be held largely responsible for this, as often, when ordered to capture desperadoes, they resign sooner than run any risk. At one time the Welsh were very dissatisfied with the government, but things have settled down now ; but I consider it unlikely that these territories of Patagonia will always remain part of the Argentine.

So much of the population—in the Chilian as well as the Argentine portion—is made up of other than Latin races, and these settlers and their descendants—British, German, Boer and Austrian—are so much more progressive than the more or less effete race by which they are governed, that in time—it may and will be years—they will break away from the governments by which they are ruled and establish a republic of their own.

At present such an event can only be regarded as a dream—and a far distant dream at that—for the naval and military forces controlled by the Argentine and Chilian governments could easily suppress any rising by force of numbers alone, but the probability is that it will come.

*The Pastoral Industry.*—This must be treated under three separate headings, as the conditions under which sheep and cattle exist are completely different in southern Patagonia from the mode of management in central, and again central Patagonian conditions differ from those to be found in the north.

This is doubtless owing to the fact that south of the Santa Cruz river the country has largely been settled by Britishers from the Falkland Islands, while in the north the settlers are mainly Argentines or other nationalities who have all come from or been accustomed to the methods of keeping stock in vogue in the Province of Buenos Ayres and the other provinces.

Central Patagonia is more or less in a transition stage, a place which has only begun to be peopled within the last seven or eight years, and where the two streams of settlers (from north and south) are at present beginning to meet and where two alien factors—the Boers and the Welsh—have also to be taken into account.

Southern Patagonia may be taken as that part of the country south of the Santa Cruz, and here most of the country which is of any use for running stock is more or less fenced, and the farms divided into paddocks. In this part the methods of managing the stock farms are very similar to those in use in Australia and New Zealand. It is essentially a sheep-raising district, and enormous numbers are raised for the sake of their wool and to a lesser extent their carcasses. Several freezing works have been erected here and there on the coast, and the meat is exported to England in a frozen state.

Estancieros living far from these works have to depend almost entirely on wool for their returns, as when sheep are driven far, through fenced country, they lose condition rapidly owing to the small amount of grass on the roads, and unless fat it does not pay to export their carcasses.

The merino was the original breed kept, and during the eighties and early nineties of last century the driving of flocks of those sheep from the provinces of the Argentine to this part formed a regular trade.

As the farms were stocked gradually and the erection of freezing works demanded larger carcasses, many rams of various English breeds were introduced—chiefly Romney Marsh and Border Leicester—and now most of the sheep are half-bred Merino. The prices of course vary greatly, but the following are perhaps average: Fat wethers $16 to $20; ordinary two-year-old wethers $8 to $10; ewes $10—all Chilian money. The Chilian dollar may be taken roughly as equal to a shilling, while the Argentine paper dollar is about double. Owing to careful management and also in some degree perhaps to the fact that the farms are all fenced, scab does not affect the flocks to the same extent as further north, some flocks being entirely free of it, although in outlying farms and in places owned by natives it is not unknown. The sheep are run in grass paddocks usually several thousand acres in extent, and are entirely grass fed, being only run in and yarded for the purposes of cutting and tailing, shearing, dipping, weaning and culling old or fat stock. When free of scab the sheep are usually dipped off the shears,

but if not they may be dipped three or four times or oftener during the year. The dips are of such length as to allow the sheep a swim of a minute's duration. Hand curing is practically unknown. Many of the shearing sheds are fitted with machinery, and the majority of the shearers are Austrians. These are often very expert, shearing over a hundred a day.

Comparatively few cattle are kept in this part, as the winter is so severe that it is often difficult to obtain sufficient grass. Indeed the snow in severe winters often lies higher than the fences, and the sheep not finding grass begin to wander in search of it, and large numbers are lost in this way as well as through starvation.

Most of the estancieros keep large numbers of horses, mostly of the native (criollo) breed. The average horse stands about thirteen hands high, and its most noticeable feature is its drooping quarters. It has been found that when thoroughbred blood is introduced, the progeny gain immensely in size and appearance, but lose in their power of endurance. The colours of the horses are most varied, extraordinary numbers of piebalds being seen. Every slight variation of colour has its own special name in the language, and this may be cited as an example of the close relationship of the horse and his rider in Patagonia. The variety of colour is undoubtedly due to the practice, now given up in the south but still to be found in central Patagonia, of allowing a large number of mares to run loose with any stallion whatsoever, the most powerful taking the lead. No artificial selection is made.

Outside Punta Arenas, a five-year-old saddle horse may be bought for about £4, while further north in the territories of Santa Cruz and Chubut the same class of animal would cost from £7 to £8 sterling. The reason given locally for this is the fact of the British Government buying large numbers in the north during the South African War, and the consequent scarcity. South African experience of these horses does not seem to have been favourable, for they were stigmatised as rough to ride, many being unmanageable. I must say, however, that, with one exception, all I saw or rode were extremely quiet and easy to ride.

In northern Patagonia sheep and cattle are bred in almost equal numbers along the valleys of the Rio Negro and its tributary the Rio Limay. On the foot-hills of the Andes, also, there are large sheep and cattle ranches, although, if anything, cattle are more largely kept, owing to the ease with which a market may be found by driving them through the various passes to Chili. Wool, on the other hand, has to be carted a great distance to the eastern coast, as practically none of the passes are suited for wheeled transport. Comparatively little fencing is done, for most of the ranches border a lake or a river, and away from the depressions bordering these the land is bare, sterile and uninviting to stock inclined to wander.

The cattle are never yarded, but are gathered together twice a year for branding purposes and the separation of those fit for the butcher. This time, known as the "rodeo," is when the Gaucho is seen at his best, riding in and out of a mob of semi-wild cattle, now lassoing and tying up a calf, and then separating the cattle into two or more distinct

lots. The ordinary run of cattle are worth from $40 to $60 Argentine according to distance from a market.

Scab is very prevalent among the sheep, dipping being seldom done, and hand curing takes its place. To do this, the sheep are yarded, and those infected with scab are singled out, caught, and thoroughly rubbed with sulphur, arsenic, tobacco juice, etc. The clean sheep having thus been brought into such close contact with scabby animals, and not receiving any application, themselves become infected, and the disease instead of being stamped out increases and spreads.

The sheep are mostly half merino, half the native Argentine breed, with thin long bodies, long legs and coarse wool, and are worth about

Sheep in northern Patagonia.

$3 Argentine. The clip varies from three to five pounds of wool, which is poor when compared with the six to nine pounds obtained in the south.

A curious custom is still sometimes seen. A dog is taken away from its mother when quite a small puppy and given to a sheep to be mothered, or if, as is usually the case at first, the ewe objects, she is held while the puppy sucks. The dog is castrated and kept quite away from his own kind, and in time comes to look on the sheep as his own special care, shepherding them most carefully, and only leaving them to obtain his daily rations. He is most useful in keeping off other dogs, and also pumas.

Large numbers of mules are bred in this part of Patagonia, and they are very useful hardy animals, three mules living where one horse would die. They will carry packs up to 120 lbs. in weight, day in, day out, and never get sore backs. These animals are worth about £12 apiece,

while a horse is only worth about £7. Horses broken to harness are worth a few pounds more.

The Gaucho habit of never riding a mare must be noted. It has been ascribed to a false idea of pride, but in a country where horses are always running loose it is difficult to prevent a mare from having a foal, and a mare with a foal at foot is so much in the way that mares are never ridden except in cases of necessity. This, in a country where horses are so plentiful and so cheap, would only be done by a very poor man, and he was more or less looked down on by his more fortunate brethren. Mares, therefore, are seldom broken in save the madrinas of troops, and these are always trained to stand to be hobbled, and often to carry packs. In the south we were several times offered unbroken mares if we cared to take them away, and £2 is the highest price ever obtained for them there. Further north they are worth about £4, and they are often used to tread the clay for brick-making. In central Patagonia this old prejudice has largely disappeared, and numbers of mares are used for riding. I believe that in the early days in South Africa the Boers also held similar ideas.

The Gaucho's chief ambition is to own as good a tropilla of horses as possible, and very often they endeavour to obtain all their horses of the same colour, and as well matched as possible.

In central Patagonia, such wide stretches of country are practically desert that it is only in a few favoured spots that stock can be run at all. In the Chubut valley, where the Welsh colonists have been settled for some forty years and a large amount of alfalfa is grown by the aid of irrigation, the farms are small, averaging about four hundred acres. Further south, in Colonia Escolante, about four hundred families of Boers own a square league each, and sheep-breeding is the chief industry, as it is also in the Argentine "Colonias" of Sarmiento and San Martin.

These Patagonian "Colonias" are nothing but a collection of small estancias where men with little capital can settle and breed sheep and cattle in a small way. They were originally intended to be agricultural settlements, but the climate proved unsuitable. There are a few large estancias on the coast near San Julian, but this part has been settled from the south, as likewise the Eisen and neighbouring valleys.

Numbers of settlers have squatted round Lago Buenos Ayres, these mostly coming from the north. So far few have built houses, and their stock is allowed to run free on the grassy vegas of the headwaters of the Deseado. These men are to be found here and there all over the country where sufficient grass and water can be had, and own no land and pay no rent, but simply squat on any unoccupied piece of ground. If they make sufficient money they may perhaps buy the land later on, but any one may apply for the land in the meantime, and if it is granted the squatters have to go, although previous to leaving they often are a great source of trouble to the owner.

Cattle are very cheap in this part as there is no market for them, and I was offered some fifteen hundred head at £2, 10s. apiece. Another man told me he would be very glad to sell all he had—two thousand—

if he could get 17s. ahead for them. The want of a good market thus makes cattle-ranching unprofitable, but sheep pay well.

The making of charqui ought to be a profitable undertaking, but so far it is not done on a large scale. Charqui is merely meat cut into strips and hung up to dry in the wind and sun. In the Province of Buenos Ayres large quantities are made and exported to Chili and Brazil, while in Patagonia when an animal is killed and all the flesh is not at once required it is often turned into charqui. In appearance black and dried, charqui is very tough, but it makes excellent soup. Mutton and horse flesh are often charquied, but beef makes the best kind.

*Routes and Projected Railways.*—The chief roadways in Patagonia are those leading from various ports on the coast inland, and, owing to the general outline of the coast, nearly all run directly east and west. The only exceptions to this are two roads leading from Punta Arenas, the one to Ultima Esperanza on the Pacific coast, and the other separating from the former at Cabeza del Mar and running north-east to Gallegos. Both of these tracks are, for the most part, fenced, and are plainly marked by the number of stock and vehicles which annually pass over them.

None of the roads in Patagonia are roads in the English sense, as they are simply tracks, more or less plainly marked according to the amount of traffic, and are only formed by the feet of horses and bullocks and by wheels treading down the grass and finally marking a roadway.

The road from Punta Arenas to Gallegos (fifty leagues) may be followed on to Puerto Santa Cruz, and continues, always fairly well marked, right along the coast to the mouth of the Rio Negro and further north to Bahia Blanca. The country it passes through is low lying with small hills, dry and uninteresting.

There is a fringe of farms and settlers to be met with as far as Madryn, after which there is a "traversia" or desert of some fifty leagues with only one set of wells until Rio Negro is reached. No other difficulty need be encountered, and one may generally camp at a farm-house every night.

The western route north is only marked as a roadway as far as Cerro Castillio, and after that one has to be guided by the configuration of the country. First one crosses the Baguales by either of two passes, the one leading down the Centinela, where there is always abundant grass and water: the other, after crossing the cumbre or summit of the range, follows the valley of the Arroyo de Bote, but at times this is dry. By either route one must cross the Santa Cruz at the ferry about three leagues east of Lago Argentino, as this is the only place, save at the mouth, where it is possible to cross this swift, wide river, unless by swimming, and this, always dangerous, is impossible with pack horses. There is also a third route to the Paso la Santa Cruz, which leaves the main road from Punta Arenas near Paton's Estancia (Rio Turbio), and keeps to the east of the Baguales range, but here water is always scarce, and, unless one travels with a guide, very difficult to find. Then from Rio Santa Cruz one may follow the Rio Leone to Viedma, or one may

cross the intervening meseta in a day, and then the Paso de los Indios to Lago Tar. Thence one may reach the Chico either by Lago Cardiel, or directly by three or four days' travelling north-east, and I should advise any one to take the latter route, and not bother about striking the lake. There is an alternative route *viâ* San Martin and direct north from there, but one often encounters snow, and the route is stony, although water and grass are always available.

From the Chico two routes may be followed, the one we took *viâ* Cerro Poire, and another cutting north from Lago Belgrano to Lago Pueyrredon, Lago Gio and *viâ* Rio Antiquas to Lago Buenos Ayres. The latter route is longer, but very beautiful, and no mistake can pos-

The Paso de los Indios.

sibly be made, as so many lakes are met with, and have to be skirted *viâ* their eastern ends. One or two settlers have recently squatted on Rio Blanca and Lago Pueyrredon, but I do not know where their estancias are situated. East of Cerro Poire the country is arid and a maze of hills, and if one gets too far to the east, water is practically non-existent.

From Lago Buenos Ayres there is a traversia of some fifteen leagues to Rio Guenguel, where in summer there are always Indians encamped, and a track has been fairly well marked by the cattle of Tristan, one of the squatters at the lake. The traversia may be avoided by following up the Fenix, and then only five leagues of desert need be crossed.

From the Guenguel to the Mayo is another fifteen leagues, and here one strikes a branch of the Camino de los Cordilleras, which, keeping to the west of Colonia San Martin, finally touches Lago Nahuelhuapi,

passing through Colonia Diece-seis de Octubre. An alternative route is that *viâ* Lago Fontana, but there is no track, though one is assured of abundant grass and water.

To go south again, there is a well-marked track from Gallegos to Lago Argentino, running through well settled country for some fifty-four leagues, and, though the grass is poor, there is always water. Then from Santa Cruz one finds a track which follows the river of the same name on its south bank, and joins the Gallegos trail five leagues east of the lake. The wagons belonging to Estancia Benvolot have also marked a trail from Lago Viedma to Santa Cruz, sixty leagues in length from the east end to the Lake. A road runs from Santa Cruz up the Chico valley, and divides where the Chalia joins the former river, one branch leading to Lago Tar and Lago San Martin, while the other follows the western bank of the Chico, but it is often difficult to find, as it gets lost in the wide vega, and the marshes there are very dangerous. A trail has recently been broken from San Julian to the Chico, reaching the river about twelve leagues above the Chalia confluence, but it is very difficult to follow, and water and grass are scarce.

Further north a fair road leads to within fifteen leagues of Lago Buenos Ayres, following the Deseado valley from the port of that name, and there are also trails to the same spot from Caleta Olivia and Comodoro Rivadavia, the former being poorly marked as yet, but with more grass and water than the latter, which for forty leagues is part of the Camino de los Cordilleras. This Camino is very well marked, but in parts near its eastern end water is scarce and has to be carried.

From Comodoro Rivadavia to Colonia Sarmiento there is a well-marked trail, and an old trail leads here along Rio Senguer from Port Madryn, as well as others from Melaspina and Deseado. A trail follows the Chubut valley from Rawson to Colonia Diece-seis de Octubre, and from here to Nahuelhuapi is some sixty leagues. From Lago Nahuelhuapi to General Roca, on the Rio Negro, takes three days by boat, but the river is full of snags and dangerous. General Roca is on the Neuquen railway which leads to Bahia Blanca.

The Santa Cruz is the only river in which water transport might be made use of, but so far the swift current has prevented anything being done. Various schemes have been tried and failed, but I think it is quite possible that a fast flat-bottomed stern wheeler, capable of say 14 knots in calm water, would be successful. The rapidity of the current would necessitate a fast boat, but the channel would need to be carefully chosen. The Rio Negro, which has a six-knot current, has been navigated by special steamers for over twenty years as far as General Roca, and there seems to be no reason why the Santa Cruz might not be utilised in the same way. It would certainly save a great deal in the cost of bringing wool to the coast.

Various railways have been proposed, but at present there are none save one in Chubut, running about forty miles inland. Those projected include one from Port Deseado to Lago Buenos Ayres, one from Comodoro Rivadavia to the same place, extending northwards to San Martin and Diece-seis de Octubre, to connect these with one running

from San Antonio to Lago Nahuelhuapi, and also linked to the present Neuquen railway.

The present Chubut railway will also some day be extended inland to Diece-seis de Octubre, and form another artery for the conveyance of the world's trade.

Work has been commenced at San Antonio, and railway material had begun to arrive at Comodoro Rivadavia when I was there, but when any of the lines will be completed is a matter of chance, as they are being constructed by the Government, and at least half the money granted for expenditure on any work finds its way into the pockets of the various officials entrusted with carrying it out. Indeed, when these

The trail in the Deseado valley.

railways have been built, it is a question whether they will pay, as at present the amount of wool grown is not sufficient to keep, say, a hundred trucks running for more than six weeks in the year, and there is not much prospect of the wool industry being increased to any extent. Practically no mining is carried on, and cattle find a better market in Chili than there will ever be on the coast of Chubut.

There are comparatively few routes over the Andes into Chilian Patagonia. After crossing the Baguales range—which, after all, is only a spur of the Cordilleras—the first pass is one from Lago Belgrano to the Chilian coast, near the mouth of Rio Baker. There is no road or track, and only two or three Gauchos seem to have ever crossed.

Then one can reach the Pacific from Lago Buenos Ayres, partly by boat and partly overland, but Rio Baker is not suited for navigation, and an attempt to colonise the Chilian end of the lake ended in failure

owing to the difficulties of transport. Lago Pueyrredon or Lago Cochrane, as the same lake is called in Argentine and Chili respectively, flows into Rio Baker, and here the same difficulties are met with.

Further north a track follows the valley of the Mayo, and from here a road has been cut and made to the Eisen Estuary. This road, which is really quite a remarkable piece of engineering, was constructed by a New Zealander, who had no previous experience of this sort of work. Unfortunately the road is in the hands of a private ranching company, and not available for the passage of stock.

Other passes are to be found near Rio Pico, Lake Fatalofquen, and San Martin de los Andes, north of Lago Nahuelhuapi.

*The Boer Colony.*—Owing to the general unrest and poor condition of trade in South Africa after the war, and also owing to the anti-British feeling on the part of some of the Boers, many left their native country to try their fortune in other lands. The wandering spirit and lust of travel added to a dislike of control handed down to these men from former generations of Voor-trekkers may also have had something to do with this efflux of settlers from the Cape. Amongst the wanderers was a Mr. Louis Baumann, a native of the Orange Free State. On arriving in the Argentine, he travelled far and wide looking for land on which to settle. Finding none in the north sufficiently cheap and yet within easy reach of a market, he went south to Patagonia. No land being suitable in the Chubut valley, he gradually made his way further south, and, at a point a few miles north of Comodoro Rivadavia, he found a place where he thought it would be worth his while to settle. He obtained a concession of some hundred square leagues from the Government on condition that he would find the settlers if he had the right to say who would be allowed to take up land, and that the settlers must be connected in some way or other with South Africa. On writing to friends in Africa that he had found a tract of country which he considered suitable for settlement, many came out, at first in twos and threes, but soon in larger parties. On reaching Comodoro Rivadavia and seeing the appearance of the land on the coast many left again with the same ship, while others remained, took up land and settled down. Since then many have left, but others have arrived. Then the colony was enlarged to take in three hundred more leagues of country lying to the west on Rio Senguer, but much of this is unsuitable. Each man was given a league of land on paying so much down, but the title was not to be finally secured until he had resided on the property for so many years, carried out improvements to a certain value, and become naturalised as an Argentine subject.

At the time of my visit, many had completed these conditions for several years, but even then could not obtain their titles. To do so would have necessitated a visit to the Land Office in Buenos Ayres, and even then, unless they were prepared to expend a large amount in palm grease, it would be hopeless to expect to get their titles. Few could afford to do this, and were living on the land unable to sell, raise money on their property, or do anything with it. Having become naturalised as Argentine citizens, they could not appeal to the British consul for

redress, and even could they have done so, I fear it would have been unsuccessful, as the policy of our consuls, I regret to say, is always one of non-interference.

Of late years very few fresh settlers have arrived, there being at the time of my visit about three hundred families settled in the colony. These were for the most part desirous of returning to South Africa, if only they could obtain a title and sell their land. The principal reason for this was perhaps the recent union in South Africa and the prospect of affairs there brightening, but also there was the feeling of general insecurity of life and property, and more particularly the want of a good market close at hand.

For the last four or five years drought has never been far distant, and has done great damage, more especially as most of the land in the colony is very sandy in character, and even in the best of seasons cannot be described as very fertile. At the most a square league will only carry a thousand sheep, and eight hundred may be taken as a good average.

The Boer, through having been accustomed to a country where native labour is cheap and plentiful, does not take kindly to a land where, as in the Argentine, labour besides being both dear and scarce is also extremely independent, and where one's peon if roughly spoken to or ill-handled in any way does not think twice of throwing up his job or even sticking his knife between one's ribs. The Boer thus finds that a greater amount of work has to be done with his own hands, and in consequence yearns the more for his native land. They are also beginning to find that justice is impartially dealt out to all under British *régime*, and that life and property are safer there than in a country where the verdict of the law is but too often in favour of the highest bidder.

*The Welsh Colony.*—The principal reason for the emigration of the first Welsh colonists was undoubtedly religious, and had to do with the non-disestablishment of the church in Wales. Various economic causes were also at work, and finally the Chubut valley in central Patagonia was chosen as their goal.

The first boat carrying settlers and their families, along with all kinds of stores, arrived in 1865, and at once arrangements were made to enter into possession of their lands. They had been promised seed by the Argentine Government, but this was not given them, and for the first few years they had to put up with many hardships—even including famine—as the early settlers were not sufficiently adaptive to change their old habits for those necessary in a new country.

Then the little colony met with the same trouble as the Boers are now face to face with, viz., the trouble of obtaining titles to their land, and again later, when the second generation grew up, the able-bodied young men were held liable to serve as soldiers, for according to Argentine law all who are born in the country are considered Argentines.

In Buenos Ayres this has led to a custom springing up for the wives of the wealthier foreigners to go over to Monte Video whenever a child is expected, and although while in that country the child will be considered Uruguayan, this will not affect him so long as he lives in the Argentine.

This conscription question roused great ill-feeling in Chubut at one

time, the Welsh even going the length of petitioning Lord Salisbury, who was then Prime Minister. His reply was to the effect that having voluntarily placed themselves under a foreign power they must submit to its jurisdiction. Many left the colony in consequence and went to Canada, but a large number of them have returned.

Gradually, however, the colonists have been making headway, and the three towns of Madryn, Rawson, and Trelew, speak of the progress made.

Madryn is the port of the colony, and lies on the western shores of Gulfo Nuevo, which has a comparatively narrow opening to the south of Valdez peninsula. A wharf has recently been built and steamers now tie up alongside this, but at the time of my first visit we had to lie alongside a hulk and transfer goods to this and other small craft.

The town is the usual collection of corrugated iron and wooden houses and stores, rather more irregularly laid out than is usually the case—indeed most of the buildings appear to be dumped down anywhere. About the same size as Comodoro Rivadavia, it boasts of a British club and is also the terminus of what was till recent years one of the quaintest railways in existence. This, which runs inland about sixty miles to Rawson, Trelew, and Gaiman, has recently been placed under new management, but previously if a train started from Madryn, the passengers never knew when they would reach their destination, as something would be sure to go wrong: either the engine would break down or the axles would become heated, or something would happen. Indeed it is rumoured that, up till a few years ago, a train had only once made the whole journey without mishap.

A good story is told of an everyday occurrence on this railway:—"The train has stopped and the guard comes along and orders the first class passengers to get out and walk, the second class to get down and shove, while the third class have to go and collect firewood for the engine." Things are now better, and the company owns two engines, one passenger carriage, and a number of wagons, while a train goes inland and returns once a day. When in Madryn our steamer had to wait over a day for cargo, as the train broke down, and its load of bales of alfalfa was strewn for miles along the line.

The country surrounding Port Madryn is very dry and sandy, and water would be scarce in the town were it not for bores which have been sunk. Further inland the soil improves slightly, and on the banks of the Chubut river, where the three towns of Rawson, Trelew, and Gaiman are situated, irrigation has worked wonders.

Rawson, the capital of the colony, as well as of the territory of Chubut, is a flourishing little place. The signs above the shops are written in Welsh, Spanish, and English, and a weekly paper is published in Welsh. Welsh and Spanish are the principal languages, although most of the Welsh speak English as well. Each of the towns has its own football, cricket, and tennis clubs, and matches take place regularly between them. Several of the old Welsh festivals are also observed. The principal industry is the raising of wheat and of alfalfa (lucerne) for hay, and a considerable amount of produce is exported to the northern ports

of the Argentine and to Chili. Barely sufficient livestock is kept to supply the towns with meat, butter, eggs, etc., and often the two latter have to be imported from Canada. The farms average about two hundred acres, and of this only about half is cultivated. The idea of many of the colonists is to own a small piece of land, and at their death to split it up among their children. This has kept down the size of the holdings, and now many obtain only a poor living.

For the most part they do not venture far from the colony and cannot really be called a progressive set of people, although a number have ventured further afield and formed a daughter colony known as Diece-seis de Octubre, or 16th of October, right away at the foot of the Andes. There the chief industry is the raising of cattle, and a market is found by taking these animals over to Chili.

This little colony is well known and liked by the wandering Gauchos, as if they stop at any of the farms they are always sure of such luxuries as butter, eggs, milk, and honey—which are unknown on any of the native farms or estancias.

## GEOGRAPHICAL NOTES

### Europe.

**Physical Geography of the North Sea.**—Professor Camille Vallaux contributes to the *Revue Générale des Sciences* for June 15 an interesting article on this subject, which gives an account of our present knowledge as to the morphology of the floor and coastline of the North Sea, the physical and chemical characters of its waters, and their movements, including waves, tides, currents, and so forth. The article does not profess to contain anything novel, and therefore need not be summarised here, but it may be recommended as collecting together information which would otherwise have to be sought in different publications. Some of the statements will probably not obtain universal acceptance, such as the explanation of the Norwegian Gully—that deep groove off the coast of Norway—as the result of the excavating action of the glaciers of the Ice Age, as they streamed off the Norwegian table-land, but the account of the form of the sea-floor is particularly clear and instructive.

### Africa.

**River Capture in West Africa.**—M. Henry Hubert publishes in the *Annales de Géographie* for May 15 a very interesting article on the course of the Black Volta in the French Sudan. As the map shows, this river, in the vicinity of Kury, shows an extraordinary bend, obviously an elbow of capture. To the west of the bend the river flows north-east, to the east it flows south-east. Giving the name of Upper Volta to the northward-flowing portion above Kury, and of Middle Volta to the southward-flowing portion beyond the bend, we find that the valley

of the Upper Volta is continued northward into a stream of uncertain flow called the Suru—the whole of the valley of the combined stream showing the characters of that of an old river. The Middle Volta on the other hand is obviously a young stream. The Suru has not been fully explored, but a part of it shows a seasonal reversal of the current, which sometimes flows towards the Volta, and sometimes away from it. At other seasons no current exists, and the so-called river becomes a stagnant mass of water, densely covered with floating vegetation. Without going into details, which would be unintelligible without a sketch-map, it may be stated briefly that M. Hubert brings evidence to show that the Upper Volta and Suru once formed a continuous stream flowing northwards. The present Middle Volta cut back its headwaters till it encroached upon this stream and beheaded it, the uncertainty of current in the Suru showing how recent the capture has been. A tributary of the Middle Volta, the Bale, is already beginning to encroach upon the valley of the Upper Volta higher up, and soon a new capture will take place. The elbow or "loop" (*boucle*) of the Volta offers a very curious analogy to the loop of the Niger, which lies just to the north of it, and has also been apparently caused by capture. Both phenomena must be regarded as part of a continuous process by which northward-flowing rivers in West Africa tend to have their headwaters captured by the younger and swifter streams which flow towards the coast. These captures, which are still going on, are a factor in promoting the drying-up of the northern regions, and thus have more than a purely scientific importance.

A question of some interest in regard to the particular case described is the probable course of the original river now represented by the Upper Volta-Suru valley. An obvious suggestion, which has been made, is that the original stream flowed towards the Niger, but according to the author the topography makes it impossible to accept this hypothesis. The actual course of the old river must remain meantime a matter of conjecture in the absence of adequate exploration of the region, but the author believes that the existence of swamps between Aribinda and Hombori show that it flowed into a vast inland lake system, as the Niger probably once flowed into a lake near Timbuktu, and as the Shari still flows into the Chad. It will be noted that, on this hypothesis, while the original Niger system and the Upper Volta-Suru system have been captured by coastward-flowing streams, and the lakes which once received their waters have in consequence disappeared, the Benue has still to complete the capture of the Shari (cf. Captain Lenfant's article in *Scottish Geographical Magazine*, xx. p. 306), and thus to affect the drying up of Lake Chad.

## Australasia.

**Irrigation in the Murrumbidgee Valley.**—In vol. xxii. p. 551, we published a note on this subject, based on particulars furnished by Dr. J. P. Thomson. According to an article in the *Times* the great dam to which allusion was made in this note has now been formally opened,

and has been given the name of Burrinjuck. It is placed between two steep granite hills named respectively Barren Jack and Black Andrew, which rise at either side of the Murrumbidgee river. These mountains are about 2500 feet in height, and form the gateway of the long and winding gorge through which the river runs for about 200 miles in the upper part of its course. The dam which blocks this gorge is now 120 feet in height, but it is to be raised ultimately to a height of 240 feet. From Burrinjuck the river is allowed to flow, under regulation, for 200 miles down to Berembed Weir, near the town of Narrandera. From this weir the diversion canals reach out. The area which can be irrigated at present extends to 125,000 acres, but it will shortly be increased to 350,000 acres, and finally to 1,300,000 acres. But this only includes the northern irrigation scheme. In addition canals are to be cut southward from the Berembed towards the Murray river, to water the rich tract lying between the Murrumbidgee and the Murray. The completion of this scheme will raise the total irrigated area to between five and six million acres.

## Polar.

**Return of Captain Mikkelsen.**—At the end of July the Organising Committee of Captain Mikkelsen's expedition to north-eastern Greenland received news of the safe arrival of that gentleman and Mr. Iversen at Aalesund in a Norwegian whaler.

It will be remembered (cf. this *Magazine*, vol. xxvi. p. 550) that the ship of this expedition, the *Alabama*, was wrecked in the spring of 1910 off the coast of East Greenland. The crew were saved and returned to Norway in August 1910, leaving behind in Greenland Captain Mikkelsen and Mr. Iversen. These two had started on a northward journey, and it was believed that they intended to cross Greenland in the far north, and find their way to Cape York on the west coast. This scheme was apparently abandoned, and the explorers have spent two winters at Shannon Island and Bass Rock Island, and have undergone great hardships.

So far as news is at present available, the experiences of the party can be summed up as follows. In April 1910 the two started on a journey northward to Danmark Fiord, in fulfilment of their scheme of finding and bringing home Mylius Erichsen's diaries (cf. vol. xxv. p. 373), taking provisions for a hundred days with them. Going was very difficult owing to the stormy weather, and the hilly nature of the country. The border of the land to the north and south of Danmark Fiord was mapped, and in the early part of May the party reached a lake which was connected with Danmark Fiord. Here the land proved fertile, and musk oxen were shot. On the north coast of the fiord, in lat. 80° 25′, Erichsen's first cairn was found, and later a second cairn was found, with reports of the discoveries and results of the party. From these it appears that Erichsen had proved that the great mass of land, shown as an island in the map accompanying Peary's paper in this *Magazine*, vol. xix., and variously named Hazen Land, Heilprin Land,

Melville Land, and Peary Land (cf. also map showing surveys of the Danish expedition, vol. xxv.), is not an island but a peninsula, Peary Channel not running from sea to sea as shown in these two maps. It would seem that an isthmus connects Navy Cliff (= Peary's map) with Heilprin Land.

Mikkelsen and his companion apparently did not carry their explorations beyond Danmark Fiord, for towards the end of May they started southwards from Cape Riksdagen, at the northern extremity of Danmark Fiord. The party had then seven dogs and fifty days' provisions. The going was bad owing to the softness of the snow, and no traces of Erichsen's party were obtained. On June 10 the depôt on North-East Foreland was passed, and found to contain only a little food and no diaries. The depôt on Amdrup's Land had not been touched. On June 21 the explorers reached Mallemuk Mountain, very weak from scurvy. Game here was scarce, and consisted chiefly of sea-gulls. At the beginning of July the southward journey was resumed, but owing to the sledge falling into the water the instruments were lost. A stop was made at the depôt on Hovgaard Island owing to the state of the ice, but the food in this depôt was found to be spoiled by water, and on August 6 hunger compelled the explorers to start again on the journey southwards. Before the depôt on Lambert Land could be reached the last of the dogs had to be killed and eaten, and the eating of the liver caused poisoning symptoms of great severity. A stay of seven days was made at the depôt to recover strength. On September 2 the journey was resumed under somewhat more favourable conditions, as the new ice proved strong enough to carry the sledge. On September 10, however, open water to the south made it necessary to leave the sledge, tent, etc., at Bear Rocks, where the party landed. Thereafter storms which broke the new ice in the fiords made progress almost impossible, and finally the diaries had to be cached, and the two explorers struggled on for ten hours without food till the depôt at Cape Marie Valdemar was reached. Here two boxes of meat extract were found, and further on two small boxes of soup. Finally Danmark Harbour was reached after a cross-country journey on September 19. An ineffectual attempt was made in October to go back to fetch the diaries, and the winter was finally spent at Winter Harbour, the party sledging southwards to the depôt on Shannon Island at south-east point, where game was abundant. An attempt was made to reach Bass Rock Island, but this failed. In the spring of 1911 a successful journey was made northwards to fetch the cached records. Shannon Island was again reached in June, and the explorers hoped that a sealer would take them off during the summer. In this they were disappointed, and had to make up their minds to spend another winter. In November 1911 they succeeded in reaching Bass Rock Island, where the second winter was spent. An attempt to reach Angmagsalik in January of the present year failed, owing to the fact that the explorers were weak after their third winter in the Arctic. They succeeded, however, in reaching Walrus Island, and left there information which led the Norwegian sealer which ultimately rescued them to come on to Bass Rock Island in search of them. When discovered they

were very weak, with few clothes, and long hair and beards, but they recovered during the voyage.

The news of their return will be received with great satisfaction, as hope had been almost abandoned.

**The Crocker Land Expedition.**—It is announced in *Science* that this expedition (cf. *S.G.M.*, pp. 211, 269, and 319) has been postponed till next year owing to the lamented death of the leader, and the impossibility of finding a new leader in the short time available. The expedition is therefore to be reorganised, and will be carried out as a memorial to the young explorer who had so much to do with its initiation. The funds in hand are stated to be sufficient to ensure the starting of the expedition, and the material and apparatus collected is being stored till the coming year.

**Swiss Polar Expedition.**—According to *Petermann's Mitteilungen* Dr. de Quervain, a young Swiss meteorologist, has made a successful start with his proposed Greenland expedition. The plans of the expedition are given in *Le Globe*, 1, and include a crossing of the inland ice along a line considerably to the north of Nansen's crossing. The party consists of the leader and Messrs. Gaule, Hoefli, Jost, and Fick, together with Prof. P. L. Mercanton and Dr. A. Stolberg, who are not to take part in the actual crossing, but are to remain at Upernivik during the summer and winter in order to make meteorological observations, especially on the upper air currents. The party left Copenhagen on April 2 in the steamship *Hans Egede*, which took them to Godthab and Sukkertoppen, and ultimately to Holstenborg. It is expected that the expedition would set out from here at the beginning of June for Disko Bay, whence in the middle of the month the crossing was to be begun. The party were to have four sledges and twenty-five dogs, and were to take an escort over the marginal zone of the inland ice. They hoped to reach Angmagsalik in the beginning of August, the return voyage being made by steamer in September or October. According to a postcard, received by the President of the Geographical Society of Geneva from Sukkertoppen, dated April 25 (*Le Globe*, 2), the party were then in good health and spirits, and had been preparing for their expedition by minor excursions carried out during the steamer's sojourn in the ports touched at on the west coast.

## General.

**Zoological Society of Scotland.**—The *Third Annual Report* of this Society gives not only an account of the progress and finances of the Society, but also a detailed description of a proposed site for a zoological garden which has been selected by the Council. The proposed site consists of the estate of Corstorphine Hill, which includes a mansion-house, with well-laid-out grounds immediately surrounding it which extend to twenty-seven acres, together with forty-seven acres of land now used as a golf course, but eminently suitable for the purposes of a

zoological garden. The land is well furnished with growing trees and shrubberies, and has a south-western exposure, giving it the maximum of sunshine. Most of it also is well-sheltered from cold winds. The Council have obtained an option, extending to February 1, 1913, to purchase the whole estate at a price of £17,000, a sum which appears reasonable in view of the fact that the ground is already so fully laid out as to require but little alteration. An additional sum of £8000 is estimated to be required to purchase a collection of animals, and to erect the necessary shelters and accommodation for them. The Report is illustrated by a number of views of the proposed site, and by others showing wild animals living in the Zoological Garden at Dublin.

A zoological garden such as that proposed would be an exceedingly valuable addition to the educational institutions of Edinburgh, and we would earnestly press upon our members the need for aiding the project by all the means in their power. It is the intention that the open-air system be given the fullest possible trial in the garden, and, from experience elsewhere, it seems certain that the result will be to show that temperature variations have very much less direct effect upon animals than is usually supposed—a point of great geographical importance which can hardly be too much emphasised. Again, since so far as possible the Hagenbeck system is to be followed, and the animals kept in conditions recalling those of their homes, the garden will be of great importance in helping the members of the public to realise the conditions of existence in different parts of the globe, another point of interest for the members of a geographical society.

Dublin has possessed for many years a flourishing zoological garden, which enjoys the advantage of a government grant; Bristol has another which is entirely self-supporting. It seems strange that in Scotland alone the inhabitants should have to be dependent upon private enterprise for exhibitions of wild animals, these being often kept in conditions which are not only far from favourable, but are such as to minimise the scientific value of the exhibits. National patriotism therefore should come to the aid of scientific interest in recommending the Zoological Society project to the public of Scotland, and we hope that our members will set an example of liberality which will ensure its success. Subscriptions and donations should be sent to Mr. W. G. Burn-Murdoch, J.P., F.R.S.G.S., Arthur Lodge, 60 Dalkeith Road, Edinburgh, or to Mr. Thomas Whitson, C.A., 21 Rutland Square, Edinburgh, Honorary Treasurers of the Zoological Society of Scotland.

**The Royal Geographical Society's New Premises.**—It is announced that the Royal Geographical Society has bought Lowther Lodge and its grounds for its new premises. The price paid for the property is £100,000. Lowther Lodge was built at Kensington Gore by Mr. Norman Shaw for the father of the present Speaker. The construction of the building is excellent, and it is in perfect condition. The internal arrangement is such that with little change the premises will at an early date be suitable for the purposes of the Society. The reception-rooms on the ground floor will provide accommodation for a museum, a map

room, a council room, a reading room, and a secretary's office. On the first floor, overlooking the gardens, are some fine rooms suitable for a library, while close to them are others which will be used as reading, writing, smoking, and tea rooms. Above these are rooms affording ample accommodation for the Society's school of instruction, the map draughtsman, and other officials of the Society. The house has a good basement and extensive attics, which will provide storage for books or maps sufficient to meet requirements for many years.

Attached to the house are two acres of garden ground. It is probable that the Society will part with as much of this land as is necessary to enable it to build a hall large enough to hold a thousand persons. The lack of such a hall has been for many years a cause of great inconvenience. The new premises are, it is true, at some distance from the present offices of the Society. This disadvantage, however, is more than counterbalanced by the fact that the building is in a quarter of London where much scientific work is going on, and is also easy of access from all parts of the West End. The Society has sold its present house in Savile Row at a satisfactory price, and with the money thus obtained and other funds is able to defray most of the expenditure necessitated by the purchase. It desires, however, to take possession of Lowther Lodge without incurring any financial liabilities, and an appeal is therefore about to be made to the Fellows to subscribe to the cost of the new premises, upon the occupation of which the Society will probably enter in the beginning of next year.

**Photographic Atlas of Land Forms.**—We have received another circular in regard to this project (cf. this *Magazine*, p. 42). It is announced that the support received has been sufficient to justify the promoters in going on with the scheme. Publication is, however, to be delayed until the beginning of the year 1913, when the first fasciculus will appear. One of the reasons for this delay is the fact that the three members of the Executive Committee, Profs. Brunhes, Chaix, and de Martonne, as well as a large number of the members of the International Commission, are to be members of the great Transcontinental Excursion which has been organised by the American Geographical Society, under the direction of Prof. W. M. Davis, for the present summer, and it is hoped that some valuable photographs may be obtained during the course of this excursion. The circular concludes with a further appeal to scientists for copies of photographs whose subject falls within the programme of the Committee.

**Laterite and the Tropical Climate.**—In these Notes in vol. xxvii. p. 434, we summarised some recent work on the causes which lead to the formation of deposits of Red Earth or laterite in tropical countries. In the *Zeitschrift d. Gesellschaft f. Erdkunde zu Berlin*, 5, Herr P. Vageler gives an account of the subject which differs a little from that previously quoted from Mr. Harrison, but emphasises even more strongly the influence of the climatic conditions upon the formation of the deposits.

Mr. Vageler points out that the term laterite has been applied to a great variety of deposits, ranging from substances solid enough to be used for building material and road metal to fertile soil. He would therefore substitute the term Red Earth, as the more general name, limiting laterite to one particular type. Such Red Earths form the characteristic soils of the tropics, and are very widely distributed over the earth. Some forty-nine per cent. of the soils of Africa, sixteen per cent. of those of Asia, forty-three per cent. of those of South America, fall under this heading. They originate from the weathering of the underlying rocks, and their most general character is the reddish colour and the presence of hydrated oxides of iron and alumina; the other constituents vary greatly in amount. Laterite is the last stage in the process which has produced the Red Earth, and it is characterised by the predominance of these two oxides, all other constituents being present in insignificant amount, and by the presence of hydragillite and concretions of limonite. The fundamental distinction between the Red Earths and the products of weathering in cold or temperate climates lies in the absence of silicates and alkaline substances, and in the colloidal condition of the elements, whereas crystalloid matter predominates in the soils of other climates. The peculiar characters are due to the warmth and abundant moisture of the tropical climate, which enable chemical changes to be carried further than in cooler climates.

According to the author the effect of the continued action of warm water upon the rocks is to produce molecular solutions containing the hydrated oxides of iron and alumina, and also silica. Owing to the high temperature the two former are deposited as amorphous colloid masses, forming Red Earth, while the silica is carried away in solution to be deposited elsewhere. In regions where the precipitation is specially great, the Red Earth so formed is further acted upon by the warm water and true laterite is formed, consisting of practically pure hydrated alumina in the form of hydragillite, mingled with iron concretions. In the earlier stages the Red Earth may form a fertile soil, but fully formed laterite is the most barren of all soils, and will scarcely support the poorest crop of grass. Fortunately the conditions necessary for its formation prevent it from occurring over large areas.

A low temperature should theoretically check the formation of Red Earth by permitting the accumulation of acid humus, which prevents the precipitation of colloid substance. Thus in temperate latitudes Red Earth should only form over alkaline rocks—in point of fact it has been described only in limestone regions, *e.g.* in Istria. Again, as abundant water is as necessary for Red Earth formation as is warmth, in arid and semi-arid regions it should only form over rocks poor in alkali and rich in iron, in regions where the water supply is specially good. The author believes that there is evidence to show that this is the case, but thinks that the distribution of the Red Earths through the tropics requires more detailed study than it has yet received.

**Physical Oceanography.**—The *Internationale Revue der gesamten Hydrobiologie u. Hydrographie*, to which we have more than once alluded here, is publishing in its *Hydrographische Supplemente* a monograph by Professor Helland-Hansen entitled "The Ocean Waters: An Introduction to Physical Oceanography." This is based upon the lectures which the author has delivered at the Bergen Museum, in connection with the courses on practical oceanography carried on there in summer during the past nine years. These courses have been attended by a great number of oceanographers, biologists, students and others, and many persons have expressed to Professor Helland-Hansen their desire to see his lectures on physical and chemical oceanography in print. With the aid of various collaborators this is now being done, and the text is being published in English. The aim of the lectures is to give an account of modern methods of investigation, many of which have not yet found their way into text-books, and also to summarise the most recent results, especially with regard to European waters. The first instalment runs to eighty-four pages, and includes discussions of methods of depth determination, collection and preservation of water samples, salinity, temperature, specific gravity and density. Full details of apparatus are given, and there can be no doubt that when completed the monograph will form a most valuable contribution to oceanographical literature.

**The Origin of the Glacial Valley.**—This constantly debated question came up at the meeting of the *Deutschen Geographentag* at Innsbruck this year, and gave rise to the usual discussion. In continuation of this discussion, Professor Erich v. Drygalski contributes to the July number of *Petermann's Mitteilungen* a short article, with diagrams, summarising what he regards as the points at issue between Professor Penck and himself. Both admit that the characteristic glacial valley is U-shaped, but Professor v. Drygalski believes that the V-shaped preglacial valley was converted into the U-shaped one merely by lateral erosion of the limbs of the V, without any appreciable deepening of the valley. Professor Penck on the other hand holds that the conversion was effected by a very extensive deepening of the valley, and recognises two forms of erosion, the smoothing and striating effect of the ice on the upper part of the walls of the old valley, and the excavating effect on the bottom, the result being to give a marked interruption of the slope where the two types of erosion meet. Professor v. Drygalski states that he sees no reason to think that ice works in these two ways, and cannot accept the great overdeepening which Penck's view necessitates. He considers that his observations in Greenland show that ice tends to undermine the walls of the valley in which it lies, in the following fashion. The mass of ice is thicker in the centre of the valley than at the sides, and in addition to possessing a forward movement it tends to be pushed out sideways towards the valley walls. It is this lateral push which forms the trough, for its result is that while the middle of the valley floor is but little altered, the side walls at the bottom are eaten back, and the

valley is thus flattened and its walls steepened. The characteristic interruption of slope he believes is due to the fact that the upper part of the wall is affected only by the forward movement of the ice, with its smoothing effect, while the lower part is not only smoothed by this movement, but undermined as the result of the lateral push, and thus shows a steeper slope. Thus according to one view the glacial valley is practically a new formation, while according to the other it is merely the modified preglacial valley.

Professor v. Drygalski bases his views on the origin of the glacial valley not only upon his own observations in Greenland, but also upon a very careful study of the valleys of the Hohe Tauern which has been carried out by his student Dr. L. Distel. The results of this investigation appear in the *Mitteilungen d. Geographischen Gesellschaft in München*, 1, in a long and beautifully illustrated paper. Dr. Distel considers that his observations go to prove that these mountains had in all essentials their present form before the onset of the Ice Age, and the ice had very much less effect in moulding their valleys and modifying their surface than Professors Penck and Brückner believe. Even the hanging valley and the characteristic "step" of the main glacial valley Distel regards as in origin pre-glacial.

**A Summer School of Geography.**—It is announced that it is proposed to hold a Summer School of Geography in Yorkshire next year. The school is being promoted by the Universities of Durham, Leeds and Sheffield, in co-operation with the County and Borough Education Committees of Yorkshire.

## Commercial Geography.

**The Island of Cuba.**—The fifth annual issue of the *Revue de Géographie* contains, among other valuable articles, a study on the economic condition of Cuba by Mr. P. Maistre, a former French consul. His paper not only gives a striking picture of the conditions which prevail at the present time, but has also a wider interest in that it indicates the significance of the human factor in economic geography, and that from more than one point of view.

The island has an extraordinary fertile soil, and the warmth and abundant moisture cause very rapid plant growth, and yet agriculture is by no means prosperous. American capital and enterprise are being used to found and develop plantations of all kinds, but the want of labour forms a great obstacle. The small proprietor shows a marked disinclination for work of all kinds. His patch of land is easily worked by the aid of his wife and children, and its produce, combined with his handful of domestic animals, suffices for all his simple needs, and gives him abundant leisure for cock-fighting and politics—his chief amusements. On the other hand, the administration opposes the introduction of coloured labour, and the attempts to encourage the immigration of white labour have not yet been successful. Among the products sugar takes a high place; the tobacco industry has recently undergone a severe

crisis. Coffee and cocoa suffer severely from the want of labour, and considerable amounts of coffee are actually imported, though the local product is of excellent quality. There is a heavy import duty on coffee, with the result that much is smuggled into the island. Another curious little fact is that though three crops of maize can be obtained in the year, there is a very large import from the United States, and this imported grain, after paying freight and tax, is sold more cheaply than the home-grown.

Not only is agriculture backward, partly owing to indolence and partly to want of modern appliances, but many of the improvements, sanitary and other, effected by the Americans, have been allowed to lapse since their departure. It seems probable that sooner or later the island will be annexed to the Union. The difficulty meantime in connection with this, from the American standpoint, is that it would involve free admission of Cuban products, and Cuban sugar, tobacco, and tropical fruits would thus compete with the products of various States of the Union.

**Dry Farming.**—Prof. Jean Lejeaux contributes to the issue of the *Revue Générale des Sciences* for April 30 a very instructive article on this subject, with special reference to Algiers. He begins by giving a detailed account of American methods. As the subject is now fairly familiar, this part of the paper may be very briefly summarised. Dry farming as practised in Utah, Dakota, and other regions of deficient precipitation, consists in allowing the land to lie fallow one year, during which it is continually cultivated, and then growing a crop of wheat the second year. During the period when rain is likely to fall the surface is kept free by constant stirring, which permits the water to penetrate easily. After rain the surface is again cultivated to diminish loss by capillarity. A variety of ingenious forms of apparatus are employed in the cultivation, and the result is found to be that not only can sufficient water be stored in the sub-soil for the needs of the crop, but also that, owing to the pulverised conditions of the soil, and the constant circulation of water in the upper layers, nitrification goes on with great rapidity, so that the percentage of nitrates increases, and good crops of wheat are obtained. As the dry climate makes it difficult to grow forage plants no natural manure is added, and the farmers do not even make use of artificial fertilisers, believing that the encouragement of nitrification by the constant cultivation is sufficient. In some regions, however, the yield is already diminishing, and warnings have not been wanting of the great risks which are being run. These indeed are obvious, for nitrification is occurring at the expense of the organic matter in the soil, and is going on more rapidly than the products can be absorbed by the crop. Now if no new humus is added, there must sooner or later come a time when the humus content of the soil becomes exhausted, and nitrification stops for want of material. When this occurs the soil will become sterile.

The rise of Dry Farming in the United States has naturally not gone unobserved in the other regions of the globe which suffer from drought,

and for North Africa especially it has been greatly recommended. Prof. Lejeaux points out in the first instance that, as has been shown by Prof. Marès, the method, if not the name, is not unknown in the region, where it was practised by the natives in primitive fashion, and was adopted by the colonists. In Sidi-Bel-Abbès, where the cultivation of cereals is carried on with great care, a rotation of alternate fallow and wheat is regularly practised, and during the year of fallow the soil is carefully and repeatedly cultivated in order to husband the winter rain. In spite of all this care, however, the yield is not large. As an improvement on this method another has been adopted by MM. Ryf and Bourdiol, which consists in sowing the grain in strips with bare ground between the strips. This bare ground is continuously and carefully cultivated during the growing period of the crop. This method gives good results, but it seems probable that the yield will gradually diminish. The great difficulty, as in Dakota, is the scarcity of animal manure, the small amount available being here used as fuel. The colleges of agriculture are alive to the danger of soil exhaustion, and at Philippeville experiments are being made to obviate it. Some form of rotation is obviously necessary, and the intercalation of a leguminous crop is indicated. Prof. Lejeaux suggests as the ideal plan a six years' rotation as follows:—four years under lucerne or berseem, which would enable cattle to be reared; one year of beans or chick peas sown in rows, the spaces between the rows being left fallow and kept constantly cultivated: one year of wheat, sown and cultivated in the same fashion. If this be impossible the alternation of beans or peas with wheat, both cultivated on the Bourdiol method, would at least safeguard the future to some extent. Hitherto the great obstacle to a cattle industry has been cattle disease (*piroplasmosis*, due to minute parasites transmitted by ticks), but it has been found that liberal feeding with fresh fodder enables the animals to resist the disease, which furnishes another motive for the adoption of the plan suggested. The adoption of dry farming without adequate precaution will, the author believes, lead to disaster, but with the modifications outlined there should be a great future for Algiers, Tripoli, and Morocco.

**Cane Sugar and Beet Sugar.**—In a review of events of economic importance during the past year in the *Revue Générale des Sciences*, Prof. Pierre Clerget makes some interesting observations on the position of cane sugar in the world's market. As is well known, about 1883 the production of beet sugar began to exceed that of cane, and this lead was maintained till 1910-11, when cane sugar again took the lead with a production of 8,526,000 tons, as against 8,393,000 tons of beet. Though partly the result of the Brussels Convention, this change is also due to the application of scientific methods to the cane sugar industry, and to the development of new regions, notably Formosa by the Japanese, and to the increased production in the Dutch East Indies, where great attention is being devoted to the scientific development of the industry. Very marked increase in the amount of cane sugar produced is taking place in British India, in Cuba, Java, Porto Rico,

Formosa, the Philippines, etc. In Formosa there are already twenty-eight sugar factories fully equipped with modern machinery, and it is expected that during the present year the yield will be sufficient to meet the Japanese demand. Only in Egypt, where much attention is being given to cotton, in the Straits Settlements, in Central America, in Réunion, and in Spain is the production decreasing. Prof. Clerget believes that the production of cane sugar will probably go on rising, as there are greater possibilities in the way of extending the area of cultivation than is the case with beet sugar.

## NEW BOOKS.

### EUROPE.

*Plain-Towns of Italy: The Cities of Old Venetia.* By Egerton R. Williams. London: Smith, Elder and Co., 1912. *Price* 12*s.* 6*d. net.*

This book forms a companion volume to *The Hill-Towns of Italy* by the same author, which was published about nine years ago, and in which Mr. Williams won a place for himself as an authority. Readers of the present work must feel, as they follow in the footsteps of the author, that they have found in him a delightful guide to all that is best worth seeing in the shape of architecture and painting in the cities of the Veneto. The design of the book, we are told, is not to supplant Murray and Baedeker, but rather to supplement them; and, in the wealth of information and detail which it affords, it is a veritable monument of industry and of patient observation. It is well known that the patricians of Venice spread their villas across the plain over which they ruled for so long a time, and, although to-day the glory has departed from many of the towns, much remains to show how nobly they were planned and built. Many of the villas, now in a sad condition of decay, show what is left of "that extraordinary, artificial, highly cultured and peculiar social existence, which was the first of its sort in Europe, which set the mark that the French and English nobility later sought to attain; that first return to the soil by a whole polished upper class, after the dangers of country life in the Dark Ages had been removed." The villas which line the river Brenta were still beautiful in the days when Mrs. Piozzi wrote her *Glimpses of Italian Society in the Eighteenth Century.* Mr. Williams is an enthusiast in architecture, and he shows us how the great Andrea Palladio, of Vicenza, was the inspirer of Inigo Jones and the school of the English Renaissance. The province of Venetia was also supreme in the art of painting, and we have a long record of pictures by the artists of the quattrocento and the cinquecento. Mr. Williams apologises in his preface for bringing in lists of pictures in the different galleries and churches, and he advises the stay-at-home reader to skip them; but the lists will be found of value to any who care to visit the towns and hunt out the pictures for themselves, while the full information afforded by the author should enable them to dispense with the company of the local guides.

The charm which attaches to the scenery of the fertile plains of Lombardy and Venetia is well brought out by Mr. Williams in a series of word-pictures from Italy from which we should like to quote, if space permitted here. From "Padua the Learned" to "Brescia the Brave" he traces briefly the history of each of the cities on from Roman times, through the middle ages, the long and, on the whole,

beneficent rule of the Venetian Republic, up to the days of the hated Austrian domination, and of the Risorgimento which gave us Italy as we know it now.

The book is plentifully illustrated from photographs, and we can recommend it to the attention of all those who feel the spell of Italy.

*Nach Schottland, Island, und Norwegen.* Von Dr. M. Weiss. Berlin: Dietrich Reimer, 1910. *Price* 3 *marks.*

This is an account of a summer cruise in the steamer *Oceana*. The author cannot be described as an accurate observer, and Scotsmen may extract some entertainment from his generalisations on the state of this country, based on a trip to Loch Lomond and Loch Katrine and a walk through Edinburgh. Even when the author wrongs us, however, he does it not unkindly, and probably unwittingly, and his pleasantly written book may serve to amuse if not precisely to educate.

*Voyage à L'Ile Majorque.* Par M. Jules Leclercq. Paris: Plon-Nourrit et Cie. 1912. *Prix* 4 *fr.*

If any of our readers are meditating a tour in the Balearic Islands, they could not do better, so far as Majorca is concerned, than peruse this work by the well-known French writer M. Jules Leclercq. It is much more than a glorified Baedeker. The writer has made a study of the secular and ecclesiastical history, as well as of the many natural beauties of the island: and he discourses eloquently and enthusiastically on all sorts of subjects, from the marvellous history of the martyr, monk, and traveller Raymond Lulle, down to the dubious ongoings of George Sand; from the story of the triumphant career of Don Jaime, the conqueror, to a visit to the beautiful grottoes at Porto-Cristo. The drawbacks to a tour in Majorca seem to be the extreme heat, bad roads, indifferent hotels, flies, and the like, but its natural beauty and historical interest render it well worth a visit. We must add that the volume is illustrated with a number of excellent photographs.

*My Irish Year.* By Padraic Colum. London: Mills and Boon, Ltd., 1912. *Price* 10*s.* 6*d. net.*

In this work we have a series of sketches, descriptive of and illustrating some phases of the life of a section of the Irish Catholic peasantry, *i.e.* those who live in the centre of Ireland. The writer, who does not conceal his political bias, shows considerable knowledge of peasant life and folklore, and has produced a book of some interest at a time when Ireland is so prominent in the politics of the day.

*Cracow.* By Leonard Lepszy. Translated by A. Dyboski, Ph.D. London: T. Fisher Unwin, 1912. *Price* 10*s.* 6*d. net.*

In this handsome and profusely illustrated volume we have an excellent account of Cracow, the former capital of Poland. The historical part of the work is somewhat sketchy and meagre, but the author expatiates on the treasures of art both of ancient and modern times, more especially on the architecture of the numerous churches and buildings which still bear testimony to former greatness, and are well worthy of a visit of inspection. To most readers the principal feature of the book will be the remarkably good half-tone reproductions of photographs which admirably illustrate the chapters on Gothic and Renascence art.

*The Early Chronicles relating to Scotland.* By the Right Hon. Sir Herbert Eustace Maxwell, Bart., LL.D., D.C.L., F.R.S., Pres. Soc. Ant. Scot. Glasgow: James Maclehose and Sons, Printers to the University, 1912. *Price* 10*s. net.*

This book should be in the hands of every patriotic Scot. It is a reprint of the Rhind Lectures of last year, and deals with the materials from which the tangled and obscure early history of Scotland can be deduced. For the most part they are monkish or at least ecclesiastical chronicles, confused and disfigured by deliberate forgeries and interpolations, and by silly narratives of fabulous miracles. But such as they are, they are skilfully dealt with by the experienced hands of Sir Herbert Maxwell, whose purity of style and literary grace are too well known to need mention. He gropes his way through the tangled jungle with critical acumen and judicial impartiality, a wise sense of proportion and an earnest desire to get at the truth. He makes no claim to originality of treatment or research, and heartily acknowledges the invaluable labours of antiquarians like the Inneses, Macpherson, Laing, Skene, and Mr. Anderson, who is still with us, on whose patient and laborious investigations he has, he tells us, based these lectures. If there is one point on which greater stress is laid than on others, it is that of the ancient claim of the Kings of England to the homage of the Kings of Scotland, and it is satisfactory to our Scottish pride to find that in the opinion of so good a judge as Sir Herbert Maxwell this claim is unfounded either in justice or equity.

*The Story of Coventry.* By Mary Dormer Harris. London: J. M. Dent and Sons, Ltd., 1911. *Price* 4*s.* 6*d. net.*

The publishers of the Mediaeval Town series made a very happy selection when they commissioned Mary Dormer Harris to write the *Story of Coventry*. Her previous publications had to some extent prepared her for the work, and it is obvious from a perusal of this book that she has made a patient and exhaustive study of the available records and documents connected with the town. She has thoroughly mastered its history and imbued herself with the spirit of the ages which she describes, and she is equally successful in depicting the condition of the citizens when suffering from the quarrels between the Church and the Barons, or from the turmoils and confusions arising in the Wars of the Roses. With considerable, but never wearisome, detail she sets forth the origin and gradual development of municipal government, and of the various guilds, and the story is abundantly illustrated by quaint personal incidents and anecdotes. Probably to many readers the most interesting parts of this book will be the chapters in which the author describes in graphic and picturesque language the daily life of the citizens in bygone days. She has made a careful study of the architecture of the principal buildings, and any of our readers who visit Coventry could not desire a more interesting or judicious guide. The numerous line illustrations by Albert Chamber are excellent.

*In Chateau Land.* By Anne Hollingsworth Wharton. With 25 Illustrations. Philadelphia and London: J. B. Lippincott Co., 1911. *Price* 8*s.* 6*d. net.*

The fascination of the Touraine Châteaux seems to be as abiding as that of Mary Queen of Scots who herself enhances their glamour with the story of her early days. The latest writer is an American lady, already favourably known, who tells of her wanderings (which start by the way at the Italian Lakes) in easy

and pleasant style. The narrative is enlivened by the company in which she travels and especially by Miss Cassandra, who belies her prototype in being the sprightliest of the party. Without pretending to authority in the history or architecture of the district, the writer has an adequate acquaintance with the standard works—which she professes on occasion to read on the shelves of old bookshops or borrow from hotel companions—and her comments show appreciation and discrimination. We notice some errors of printing *e.g.* Tournageau, Machiolation, Joli Marie. The numerous illustrations of themselves invite a perusal of the book.

*The Story of Canterbury.* By S. R. Stirling Taylor. Illustrated by Katherine Kimball. Mediaeval Town Series. London: J. M. Dent and Sons, 1912. *Price* 3*s.* 6*d. net.*

To any one who has recently perused this book a visit to this, in many respects the most famous of English towns, should prove of surpassing interest. The writer traces the history of the town from pre-Roman days till the Reformation, and shows how many events which happened within its walls shaped the history of the Kingdom of which it was and still is the ecclesiastical centre. This is done in a way which sustains the interest of the reader from the first, and he will find the chapters on Thomas Becket and the rebuilding of the Choir of the Cathedral among the most interesting in the book. With the itinerary of Canterbury, including the Cathedral and Priory of Christ Church, as sketched in the last chapter of this volume, in one's hand, the tourist may be sure that no part of the town which is at the present day worthy of note will be overlooked.

The book is profusely illustrated with well-executed sketches of many of the principal features of the town, among which, as a matter of course, portions of the Cathedral predominate.

## ASIA.

*Ruins of Desert Cathay: Personal Narrative of Explorations in Central Asia and Westernmost China.* By M. Aurel Stein. With numerous illustrations, colour plates, panoramas, and maps from original surveys. In Two Volumes. London: Macmillan and Co., Ltd., 1912. *Price* 42*s. net.*

In these two bulky volumes Dr. Stein gives a report upon his work in Chinese Central Asia during the years 1906 to 1908. The ground-plan is that of a narrative of his numerous journeys, but the main interest lies in the minute account of his exploration of ruins long buried in desert sands. The nature of the climate caused a division of the work into two well-marked portions. The summers were devoted to the uplands and mountain regions watered by glacier streams, and bracing—sometimes too bracing—in temperature. Only during the winters were the dry deserts accessible, when stores of water could be carried in the form of ice. Thus it was only in the short intervals between these seasonal undertakings that the author could enjoy medium weather in some favoured oasis. Dr. Stein was the only European in the party, but he was well served by subordinates brought from India, and by a young Chinese secretary, to whom he gives very high praise. The Chinese officials also, in whose districts he travelled, were most cordial and helpful, and many of them took an intelligent and scholarly interest in his archæological labours. From a geographical point of view the most valuable portion of Dr. Stein's work, apart from the mapping of previously unknown parts of the Kuen-Lun and Tian-Shan ranges, is the evidence he produces relating to the desiccation which is said to have been proceeding in

Central Asia during historic times. For a full statement we must wait for the more detailed scientific reports. Dr. Stein does not make it quite clear at present what his real views are, but he certainly hints that important changes in the hydrography of the region have occurred, and that possibly these may explain the ancient cities buried in sand. We know already from Dr. Hedin's work that the lower Tarim has repeatedly changed its course. Dr. Stein found that the delta of the Heriga had moved several miles from the position assigned to it by the Swedish traveller. Other rivers in Central Asia frequently forsake old beds for new ones. It may, then, amount to this, that what once was desert is now sown, and regions formerly fertile have become barren wastes of sand. One thing is certain, that under a more enlightened government such as China bids fair to possess, extensive irrigation works will be undertaken, and much water, which at present is allowed to become lost, will be utilised in extending agriculture.

Dr. Stein bears witness to the accuracy of Marco Polo, and there are throughout many pleasing references to Hsüan-Lang, the Chinese Buddhist pilgrim, whom the author call his patron saint. The buried cities in the desert provided valuable and indeed unique relics, while the explorations along the line of the old western wall brought to light much that belonged to the beginning of the Christian era, when China was at the zenith of its power. At the cave temples of the "Thousand Buddhas" a vast store of ancient manuscripts was discovered, and by the exercise of skilful diplomacy a large selection was removed, and eventually conveyed in safety to the British Museum.

The illustrations, including some reproductions in colour of frescoes from ancient temples, are numerous and excellent, while the maps are admirable, and the index exhaustive.

## AFRICA.

*L'Afrique Équatoriale Française.* Par Maurice Boudet-Saint. Paris: Plon-Nourrit et Cie, 1911. *Prix* 3 *fr.* 50 *c.*

M. Boudet-Saint is an author well known in France, a former work of his, *La Grande Boucle*, having received the Montyon prize on the award of the French Academy. He has travelled much, and has made a special study of French colonies, and in this work he gives us his impressions of French Equatorial Africa. It cannot be pleasant reading for his compatriots, especially as it is heralded by a preface by M. Marcel Saint-Germain, Senator and President of the Committee in the Senate more especially in charge of the colonies, who vouches for the author's patriotism, ability, and trustworthiness. It may be described as a severe indictment of the administration by the French Colonial Office of their African empire in practically every department of their work, and an acknowledgment that little or no success has attended the administration. M. Boudet-Saint does not despair of the future, but he has little mercy on the past. His strictures are all the more pungent as he now and again draws a comparison with the administration of the Belgians in the neighbouring Congo State—an administration which, we need hardly say, has been subjected to severe criticism of late years—and points out that the Belgians have held the Congo State for only thirty years, while the French have been in Equatorial Africa for seventy. He denounces freely the maritime communications between the mother-country and Africa, and urges, for several good reasons, that the present port of Dakar at Cape Verde should be superseded by a new port at Cape Lopez farther down the coast. He proceeds to point out that, in the absence of roads and means of communication, the country is practically closed to travellers and tourists, and even to sportsmen.

There are a number of sights and objects of interest sufficient to attract travellers and tourists, and plenty of big game, but in the case of the former there are no means of getting to the places of interest, and in the case of the ordinary sportsman the cost is prohibitive. A large part of the work deals with the all-important question of the deficiency of population. It is stated quite frankly that the inhabitants disappear at the advent of the white man, and two principal reasons are assigned: the one that they do not care for labour, and the other that they object to be taxed. M. Boudet-Saint is of opinion that forced labour under well-regulated conditions would be of much benefit both to the natives and to the administration. It is also alleged that they are insufficiently fed, and are decimated by the scourge of sleeping sickness. Incidentally M. Boudet-Saint mentions that some people think that the suppression of cannibalism, by depriving the population of a *wholesome and abundant nourishment*, has increased their degeneration! Smallpox and consumption contribute their quota to the general misery. There is no hope of replenishing the population from adjoining territories, and M. Boudet-Saint thinks that the immigration of Hindus and Chinese should be encouraged. These are a few of the subject-matters dealt with in this most interesting book, which is well worth the perusal of our readers, and should cause no little sensation in France. It is not surprising that a second edition has been found necessary.

*The Cape of Adventure.* By Ian D. Colvin. London and Edinburgh: T. C. and E. C. Jack, 1912. *Price* 10*s.* 6*d. net.*

A perusal of this most interesting and most disappointing book leaves no doubt in our mind that there is ample room for a Hakluyt Society in Cape Town and abundance of material for its operations for many years. Indeed, Mr. Colvin states that he has already made some such proposal, but that he has little hope of any result. We trust, however, that this volume will secure a wide circle of readers in South Africa and elsewhere, who may be inclined for patriotic reasons to adopt the suggestion, and make an earnest effort to rescue from undeserved oblivion a wide selection of the exceedingly interesting archives, which are now buried away in the cellars of Parliament House, Cape Town. We have said the book is disappointing, and for this reason. We have placed before us a number of more or less brief extracts, every one of which is intensely interesting; in some we long for the beginning of the story; in some we long for the continuation; in every case we do not get nearly enough. What we do get merely whets the appetite. Wild, fantastic, incredible almost as they appear, the stories have the stamp of truth upon them, written as they are for the most part by rough, simple, valiant adventurers, be they sailors, soldiers, ecclesiastics or traders, who do not write for effect, or conceal the credulity and simple piety of the long-ago centuries when they wrote, or the characteristics and peculiarities of their nationality or training. Of their gallantry, endurance, perseverance and fortitude under crushing calamities there cannot be the slightest doubt, and there is ample evidence that they were in no way deficient in the milder virtues of patience, gentleness, unselfishness and brotherly kindness. The extracts given in this book are taken from documents which cover three centuries, and are illustrative of various nationalities, viz. English, French, Portuguese and Spanish, and thus there is a continual variety of style as well as of subject. It has been well said that Hakluyt's *Principal Navigations* are the prose epic of England, and Mr. Colvin in this fascinating collection clearly shows that there is abundant material for a similar prose epic of South Africa. We must not forget to mention the many quaint illustrations, several of them dating from the eighteenth century.

*La Colonisation Française dans L'Afrique du Nord.* Par M. Victor Piquet. Paris: Librairie Armand Colin, 1912. *Prix* 6 *fr.*

In this substantial and interesting volume the writer brings to a conclusion his survey of the history and colonisation by France of the north of Africa. The first volume was noticed in the *Scottish Geographical Magazine*, vol. xxvi. p. 214, and dealt mainly with the history of the tract anterior to 1830. In this volume the author surveys in great detail the French systems of colonisation in Algeria and Tunisia, greatly to the advantage of the latter. The main point of difference between the two systems seems to be that Algeria is and has been administered directly from Paris, and has suffered grievously from the political events and changes which have from time to time occurred in France, and more especially from having been the area on which French statesmen have not hesitated to impose their own theories of colonisation without reference to existing facts, or to what their predecessors have done. Tunisia, however, has had more considerate treatment. It has been treated as a Protectorate: due allowance has been made for local conditions, and the government is carried on as much as possible by native agency and under local laws, very much, indeed, the same system of government which the British have long maintained in India. Under this system Tunisia has enjoyed rest and prosperity which have been denied to Algeria. We must refer our readers to the book itself for details which demonstrate the advantages and disadvantages of the two systems. M. Piquet has spared no pains to make his work as complete and accurate as possible. He goes into great detail—detail that may perhaps weary an English reader, but which will be found most instructive and interesting to French officials and readers interested in the premier colony of France. He has the courage of his opinions, and does not hesitate to criticise freely and candidly the acts and policy of the past. He makes due allowance for the difficulties of the tasks imposed on the local officials, and for sudden and overwhelming difficulties such as were inevitable in 1870. He recognises the delicacy of dealing with a variety of fanatical and turbulent tribes, and with the numbers of immigrant foreigners who have settled in the colonies. It is remarkable to find that while in 1909 there were only 40,850 French inhabitants in Tunisia, there were no less than 105,700 Italians, 60,000 Jews, and 12,200 Maltese. In Algeria at the last census the total population was almost five-and-a-quarter millions, of whom rather less than half a million were French. There can be no doubt but that France has done, and is doing excellent work both in Algeria and Tunisia. An unimpeachable authority, Sir Harry Johnston, tells us that in Algeria France has drained innumerable swamps, and planted millions of hectares of treeless plains and bare hillsides. In the Sahara she has dug artesian wells, and thus greatly increased the supply of barley and dates. The reduction in the numbers of the wild animals has helped to conserve and increase live stock. She has waged most successful war against locusts. In Algeria she has constructed over 2000 miles of railways, and 1900 miles of roads fit for motor traffic, and in Tunisia 670 miles of railways and 1800 miles of motor roads. Thirty years ago it was unsafe to travel outside the principal towns without an escort: now Algeria and Tunisia are as safe for travellers as France itself.

As to Morocco M. Piquet points out that, as yet, there has been, of course, no time for France to attempt to colonise it, and that, socially and internally, its condition is still that of the Middle Ages—a despotic Sultan, many turbulent and tyrannical subordinate chiefs, a number of semi-civilised tribes, more or less fanatical, and always ready to fight among themselves. He contents himself with a slight but interesting sketch of the political history up to 1910, to which he adds

short notices of the taxes, public debt, education, rights of protection and natural resources. France has not found it an easy task to colonise and develop any of her numerous colonies and dependencies, and, if we are to trust M. Piquet, the organisation and development of the protectorate of Morocco will be as difficult and arduous a task as any she has ever undertaken. On the other hand, her successes, and, still more her failures, in the north of Africa will have done much to teach her what to do and what to avoid. But on this point we again quote the hopeful words of the same authority. "Far and away the best thing for Morocco and the people of Morocco at the present day will be the distinct and clear establishment of a French protectorate over four-fifths of that country, and the reduction of the Sultan to the same position as that now honourably occupied by the Bey of Tunis. Then, indeed, Morocco will go ahead. Its native population will increase by leaps and bounds, its incalculable natural riches be thrown open to commerce, while science should gain prodigiously by the examination of wonderful monuments of the past stretching back into far distant ages of pre-history. There will be revelations of a palaeontological fauna almost rivalling that of the Himalayan foot-hills; fresh discoveries ought to be made in botany, in living zoology, and the evolution of human races exceeding in interest anything yet made known in Algeria and Tunis. The good days of Morocco are just beginning."

*Chiefs and Cities of Central Africa: Across Lake Chad by way of British, French, and German Territories.* By Olive Macleod. Edinburgh and London: William Blackwood and Sons, 1912. *Price* 16*s. net.*

This is an account of a journey through West Central Africa performed by Miss Macleod in company with Mr. and Mrs. Talbot in 1910-11. The geographical interest of the book is not very great except the confirmation and supplementing of Captain Boyd Alexander's account of Lake Chad. The party traversed both lakes, and had ample opportunity of studying the Buduma, the fisher people of the lake. The two ladies were permitted to visit the women's quarters of several chiefs whose capitals they visited, and Miss Macleod gives in an unpretentious way some valuable ethnographical information. The book is pleasantly written, copiously illustrated, and very creditable to the publishers. A list of plants and a full index enhance its value.

*Animal Life in Africa.* By Major J. Stevenson-Hamilton, F.R.G.S., C.M.Z.S., late 6th (Inniskillen) Dragoons, Warden Transvaal Government Game Reserves. With a Foreword by Theodore Roosevelt. Illustrated. London: William Heinemann, 1912. *Price* 18*s. net.*

It is cheering to learn from this volume that thanks to the efforts of the Transvaal and of various British Colonial Governments the extinction which at one time threatened many species of big game in Africa has been to some extent warded off, if not absolutely prevented. The colonial governments of other European nations are also coming into line with ours in this respect. The establishment of Game Reserves has been of great service in forming as it were kinds of natural zoological gardens where the balance of nature is preserved. Major Stevenson-Hamilton as Warden of the Transvaal Government Game Reserves, with headquarters on the Sabi River, near the border of Portuguese East Africa, has exceptional opportunities of studying the habits of wild animals, and his book, although he modestly disclaims the honour, will undoubtedly be regarded as a standard work on the wild fauna of South and Central Africa. The method is

that of taking the animals by species and describing the appearance and habits of representative individuals. The style is cursive though the treatment is thorough, and the more severely scientific portions are agreeably lightened by anecdote. The numerous photographs of animals in their natural state are of great value. Several maps are inserted, showing, for example, the distribution of species in Africa, and the game reserves in British territory. There are chapters on Hunting Aids, Hints to African Travellers, and Transport, which will be of great assistance to sportsmen intending to visit the country. The author discusses the vexed question of the connection between big game and the tse-tse fly which carries the sleeping sickness. In spite of the exhaustive controversy that has taken place the general impression at home seems to be that a great deal can be said for both sides, and that a satisfactory and authoritative pronouncement cannot yet be made. A Royal Commission to investigate, as its nature is, every side of the question, is much to be desired.

*Big Game Hunting in Central Africa.* By James Dunbar-Brunton, M.D. Illustrated with Photographs and a Photogravure Frontispiece. London: Andrew Melrose, 1912. *Price* 10*s.* 6*d. net.*

Of shooting books there is no end either in numbers or in variety of treatment. The present volume belongs to the "guide to sportsman" class. One must not look for a treatise on the habits of animals, but rather for descriptions of certain expeditions, hints on the proper method of hunting various species of game, and directions as to armoury and general equipment. There is a good map and a vocabulary of common words in three native languages, including Swahili. Sportsmen bound for North-East Rhodesia will doubtless consult this book.

## AMERICA.

*A Woman's Winter in South America.* By Charlotte Cameron. London: Stanley Paul and Co., 1911. *Price* 6*s. net.*

This volume contains a number of flimsy superficial sketches in which the author describes the places which she visited during a voyage to South America, a journey across that continent, and her voyage back to England *via* Panama. The reader will learn nothing from it which cannot be found in the ordinary guide-books. It is illustrated by a number of photographs, none of them of outstanding merit.

## AUSTRALASIA.

*Australia in its Physiographic and Economic Aspects.* By Griffith Taylor, B.A., B.Sc. Oxford: The Clarendon Press, 1911. *Price* 3*s.* 6*d.*

To those in search of a reliable introduction to modern geographical ideas no book could be more readily recommended than the recent volume on Australia in the Oxford Geographies. It is one of the most successful attempts to apply the regional method that has come under our notice, and it is done by one who has seen much of the country of which he writes. Certainly the author has been fortunate in his choice of a subject, for perhaps no country better and more directly illustrates the interaction of the various geographical factors, the geological structure, the configuration, the climate, the vegetation, the industries, and the population, than does Australia. It is for this reason that the continent should be studied in our schools at a much earlier stage in the curriculum than

it is usually, and certainly before any attempt is made to study in detail the very complex geographic and economic conditions of our own land. If hitherto the necessary material has been lacking, then Mr. Taylor's book is all the more welcome, and it should facilitate the intelligent study of this part of the empire. After a short chapter on the discovery and exploration of Australia, the author devotes the first part of the volume to the physical conditions and the natural regions of the country; he has preferred to divide it into its physiographic rather than into its climatic regions. While no doubt this method is the more satisfactory, yet it renders ready comparison with other parts of the globe somewhat more difficult. One of the best chapters deals with the relation of environment and occupations in New South Wales; a definite attempt is made to trace the relation between the geological structure and the configuration of the country, and the influence of these, through climate and vegetation, upon the life of the region. A useful discussion of the main factors governing the climates of the southern hemisphere precedes the chapter on the rainfall of Australia. The second half of the book deals with the leading, and with some of the most characteristic minor industries of the country. The author always keeps in view the physical conditions upon which these industries depend, and has some very interesting and suggestive remarks to make upon the methods and history of the economic development of the country. In discussing the importance of the rainfall to both the pastoral and the agricultural industries he refers to the various schemes, by means of artesian wells and artificial irrigation, for extending or making more constant the water supply in districts where the lack or uncertainty of moisture is the only obstacle to their exploitation. One of the most successful irrigation schemes is that of the Mildura district in Victoria, where eight thousand acres have been made to support a population of five thousand, which without irrigation could not provide pasture for a thousand sheep. A long chapter discusses in great detail the railway system of Australia and the inland navigation. The book is well supplied with sketch-maps and with carefully selected statistics, which, however, might in some cases have been brought down to a later date. In discussing the future development of the country the author does not seek to conceal his distrust of the "economically unsound policy of a White Australia," but even if that policy is adhered to, there still remains a vast area suitable for close settlement; moreover, the experience of Queensland suggests that white labour can be profitably utilised even within the tropical zone, but whether a healthy white race can be permanently established in northern Australia has still to be proved.

*Pygmies and Papuans: The Stone-Age to-day in Dutch New Guinea.* By A. F. R. Wollaston, with Appendices by W. R. Ogilvie-Grant, A. C. Haddon, F.R.S., and Sidney H. Ray. London: Smith, Elder and Co., 1912. *Price* 15*s. net.*

In the year 1908 the members of the British Ornithologists' Union determined to mark the occasion of the jubilee of the Society by sending out an exploring expedition to the Snow Mountains of New Guinea. The necessary funds were provided in part by His Majesty's Government, and in part by the contributions of certain learned Societies, the proprietors of *Country Life*, and private individuals: and the Netherlands Government not only gave permission to travel and explore, but provided an armed guard at its own expense, and placed a gunboat at the disposal of the party to transport them from Batavia to New Guinea. (See Captain Rawling's paper, pp. 1-9 of present volume.)

The original intention of the explorers had been to approach the Snow Mountains by way of the Utakwa River; but it was eventually decided, after consultation with the Military and Geographical Departments at Batavia, to enter the country by way of the Mimika River; and on the 4th January 1910, the Government Steamer *Nias*, which conveyed the party, anchored at its mouth. It was not long after their arrival that they became aware of the serious mistake which they had made in choosing the Mimika as the starting-point of the expedition—a mistake which effectually destroyed any chance which they had of reaching the Snow Mountains. They had expected that a few days' march would have brought them to the foot-hills; but they found that between the sea and the mountains there lay a belt of low land, some thirty miles in width, clothed with impenetrable jungle, through which the Mimika wandered in endless windings. They established a camp at Wakatimi, not far from the coast, and another at Parimau, about forty miles further up the river, beyond which place it appeared to be hardly navigable. Owing to the lack of food in the country itself, all provisions for coolies as well as Europeans had to be brought in from the outside. Some of the stores had been badly chosen and were badly packed; and the transport was slow and difficult, owing in great measure to the wretched physique of the men who had been picked up in Amboina, and who were not only unaccustomed to such work, but quite unsuited for it. During the first months of their stay the explorers' energies were mainly expended in conveying supplies up the river to Parimau. Indeed, this labour never ended, for, as the coolies soon showed unfitness for work, and had to be sent to their homes, it became necessary to draw upon the stores already transported until a fresh batch arrived. The tedium of these occupations was increased by the monotony of the scenery. The huge trees and the rank undergrowth of the jungle shut out every prospect except a narrow strip of sky; and the shiny brown mud of the deep river banks was littered with a debris of rotting branches which the floods had left stranded. These floods were frequent and dangerous. The climate, too, sorely tried the members of the expedition. They remained fifteen months in New Guinea, and during the first twelve rain fell on three hundred and thirty days.

In their endeavour to acquaint themselves with the manners and customs of the natives, the explorers were greatly hindered by their ignorance of the language, and by the impossibility of obtaining interpreters. Very few of the inhabitants seemed to understand that the strangers wished to learn their words; and facial expression or gesture such as a European sometimes employs to convey his meaning suggested nothing to them. As a consequence little information was procured as to their religion or social organisation. But a full account is given by Mr. Wollaston of their houses, dress, weapons and utensils. Like the Yahgan of Cape Horn, they are a wandering people whose life is mainly occupied in a search for food. Like them, too, they keep fires burning in their canoes, and when they travel through the bush the men carry a smouldering stick; but it was not ascertained how they make fire in the first instance. They possess no metal, they knew nothing of pottery, and in the Mimika villages they have no cultivation. Even at places, such as Obota, where crops are raised, they are not nearly sufficient for the whole population. They recognise rights of private property, except in the case of game brought in by the hunters, which is distributed among the community; and they are accustomed to make exchanges—coconuts, for example, being bartered for bananas or tobacco. They are unconscionable thieves, and, on occasion, dangerous drunkards. It is of interest to discern that one of their customs, which they have in common with many other

peoples—for example, the Tupis of Brazil and the Guaranis of Paraguay, the natives of New Zealand, Queensland, Tahiti, New Caledonia and the Andamans, and the Ainu of Yezo—is that of shedding tears on a visitor's arrival by way of welcome.

While walking up the bed of the Kapare River to the north-west of Parimau, one of the members of the expedition—Captain Rawling—captured two small men who evidently belonged to some race other than the Papuan. They were kindly treated and dismissed with presents. At a later date the community to which they belonged was visited in its home—a large clearing in the jungle on the hill-side; and some of its inhabitants were induced to visit the European camp. These pygmy people, whom the Papuans called Tapiro, are in the habit of exchanging friendly visits with the people of Parimau, and of bartering tobacco; and it was observable that the visitors always came unarmed. In all probability they left their weapons hidden in the neighbouring jungle. The women were never seen by the explorers. The average height of the men is four feet nine inches. They are clean-built and active; in colour, they are paler than the Papuans; and their hair is short and black and woolly. It is noticeable that they make fire by using a fire-stick; and that their houses are greatly superior to those of the Mimika people. "Strangely enough, they are extremely modest"; and, although indescribably dirty, they are acquainted with sanitary arrangements unknown to the neighbouring Papuans. Mr. Wollaston gives a full account of the weapons, dress and ornaments of this interesting people.

The book as a whole forms an admirably written account of the doings of the expedition. It contains many excellent photographs of both the scenery and the natives; and in appendices are supplied notes on the birds collected by Mr. Ogilvie-Grant, an essay on the pygmy question by Dr. Haddon, and a short account of the languages in the east of Dutch New Guinea. A map and a serviceable index conclude the work.

## POLAR.

*Scottish National Antarctic Expedition: Report on the Scientific Results of the Voyage of S.Y. "Scotia," during the Years 1902, 1903, and 1904.* Vol. iii. Botany. Edinburgh: The Scottish Oceanographical Laboratory, 1912. *Price* 23*s.* 6*d.*

The work of the Scottish National Antarctic Expedition of 1902-4 is now too well known to need any introduction. The botanical work of the expedition dealt mainly with the South Orkney Islands and Gough Island, but the scanty flora of Lawrie Island was investigated during the winter of 1903, and extensive dredging operations were carried on in the Weddell Sea through almost 10,000 miles of previously unexplored waters.

The present volume, like its predecessors, is an extremely fine production, and contains no less than ten separate papers as well as an Antarctic Bibliography, and an introduction by Dr. Rudmose Brown, who has also done most of the editing of the volume. Of the papers, all, with one exception, have already appeared in various journals and transactions, and therefore our space here may be devoted to this article, which is by Dr. R. N. Rudmose Brown, and is entitled "The Problems of Antarctic Plant Life."

The Antarctic flora, though poor, is richer than was formerly supposed. Whereas the Arctic regions support a phanerogamic flora of four hundred species, in the Antarctic regions there are only two species. As the amount of light is the same in corresponding latitudes, the real reason for this discrepancy lies in the fact that

the Antarctic summer is short with very low temperatures. The Arctic summer mean is always above 32° F., but the Antarctic summer is practically always below. This reacts in two directions on plant life. In the first place the winter snow lies late on the ground, and in the second place it is doubtful if a flowering plant could obtain the necessary amount of heat required for its various life functions. "In fact," says the author, "the Antarctic summer is but an astronomical conception." Another point is that even if a species succeeded in establishing itself, the myriads of penguins occupying all available patches of ground would militate to an extraordinary degree against its survival.

As regards cryptogams, ferns are entirely wanting in Antarctica, but the total number of mosses found by all expeditions up to and including the *Nimrod* appears to be fifty-two. The number of hepatics is small, including as it does not more than six species. On the other hand a prominent feature of Antarctic vegetation is the number of lichens, not as species, but as individuals. Of multicellular algae twenty-four species were recorded, five being new. "Unicellular algae form the vast preponderance of the botanical treasures of the Antarctic regions." Although our knowledge of the Antarctic flora is necessarily incomplete, all the known facts point to a Fuegian origin. Analyses of distribution indicate this, as well as the greater number of species in Graham Land than Victoria Land, and the absence of New Zealand forms. Undoubtedly the present flora is due to the dispersal of spores and seeds by wind and birds. In connection with this it is interesting to note that Dr. Skottsberg found the pollen grains of Podocarpus among the algae in a patch of red snow, and these could only have been transported from Chili by wind agency.

Among mosses and lichens the northern element forms a puzzling problem. It may be that certain birds, such as Wilson's petrel and the northern tern, which wander between high northern and high southern latitudes, have carried spores and soredia on their feet and plumage. But a more satisfactory explanation is probably to be found in the idea that the species of mosses and lichens in question are cosmopolitan, but have not been discovered in low latitudes.

## GENERAL.

*The Land of Goshen and the Exodus.* By Sir Hanbury Brown. Second Edition. With 2 Maps. London: Edward Stanford. *Price* 3*s. net.*

Sir Hanbury Brown has introduced certain modifications into this second edition of his book, and supplies two maps showing what he believes to have been the course followed by the Israelites.

*Views and Reviews.* By Sir Harry Johnston, G.C.M.G., K.C.B., D.Sc. London: Williams and Norgate, 1912. *Price* 3*s.* 6*d. net.*

This collection of Sir Harry Johnston's essays will be very welcome to a wide circle of readers. It appeals to students of anthropology, ethnology, political history, natural history and art. The author is, of course, well known as a distinguished statesman and administrator and a successful explorer, and he has done well to reprint, after correction and bringing up to date, these essays, which set forth his mature judgment on a number of important subjects. On these he writes with the easy confidence which is the result of patient study, careful investigation and prolonged experience. He is alike judicious and impartial, and is equally forcible and convincing when pleading the cause of particular plants or animals threatened with extinction, or when dealing with some perplexing and intricate

problem of race or religion. His exceptionally wide experience enables him to eschew fads and to avoid dogmatising, and at the present time the publication of his addresses on Germany should be very valuable. The volume will be acceptable, alike to those who read the essays as they originally appeared, and to those who read them now for the first time.

*Britain on and beyond the Sea. Being a Handbook to the Navy League Map of the World.* By CECIL H. CROFTS, M.A. Edinburgh and London: W. and A. K. Johnston, N.D. *Price* 1*s.* 6*d.*

This little book contains four prefaces, a sketch of naval history, and brief accounts of British dominions beyond the sea. It is illustrated by a facsimile of the Naval League Map. We note that this is on Mercator's Projection, and the red tint is carried far into the Antarctic and Arctic regions with somewhat bizarre results. An enormously magnified Graham Land seems a "British possession" of doubtful utility.

## BOOKS RECEIVED.

*The Depths of the Ocean: A General Account of the Modern Science of Oceanography, based largely on the Scientific Researches of the Norwegian Steamer "Michael Sars" in the North Atlantic.* By Sir JOHN MURRAY, K.C.B., F.R.S., etc., and Dr. JOHAN HJORT, with Contributions from Professor A. APPELLÖF, Professor H. H. GRAN, and Dr. B. HELLAND-HANSEN. Sm. Royal 8vo. Pp. xx + 821. *Price* 28*s. net.* London: Macmillan and Co., Ltd., 1912.

*Off Beaten Tracks in Brittany.* By EMIL DAVIS. Demy 8vo. Pp. 248. *Price* 7*s.* 6*d. net.* London: Stephen Swift and Co., Ltd., 1912.

*Macdonald's Tourists' Guide to Edinburgh and South-East of Scotland* (*The Land of Scott*). Illustrated. Crown 8vo. *Price* 2*s. net.* Edinburgh: William Macdonald and Co., Ltd., 1912.

*Dans Notre Empire Noir.* Par MAURICE RONDET-SAINT. Préface de M. ABEL BALLIF. Avec une carte. Crown 8vo. Pp. vii + 336. *Prix* 3 *fr.* 50. Paris: Plon-Nourrit et Cie, 1912.

*Through the Heart of Africa: Being an Account of a Journey on Bicycles and on Foot from Northern Rhodesia, past the Great Lakes, to Egypt, undertaken when proceeding Home on Leave,* 1910. By FRANK H. MELLAND, F.R.G.S., F.Z.S., F.R.A.I., and EDWARD H. CHOLMELY, F.R.A.I. Demy 8vo. Pp. xvii + 305. *Price* 12*s.* 6*d. net.* London: Constable and Co., Ltd., 1912.

*Geographen-Kalender.* Begründet durch H. HAACK. In Verbindung mit vielen Fachgenossen herausgegeben von Dr. GEBHARD SCHÖNITH. Zehnter Jahrgang, 1912. Gotha: Justus Perthes, 1912.

*North Lancashire* (Cambridge County Geographies). By J. E. MARR, Sc.D., F.R.S. With Maps, Diagrams and Illustrations. Crown 8vo. Pp. xii + 180. *Price* 1*s.* 6*d.* Cambridge: University Press, 1912.

*Old World Places.* By ALLAN FEA. With Illustrations and Photographs by the Author. Demy 8vo. Pp. viii + 295. *Price* 10*s.* 6*d. net.* London: Eveleigh Nash, 1912.

*The Gateway of Scotland; or East Lothian, Lammermoor and the Merse.* By A. G. BRADLEY. Illustrated with 8 Coloured Plates and numerous line Draw-

ings by A. L. Collins. Demy 8vo. Pp. x + 452. *Price* 10*s.* 6*d. net.* London : Constable and Co., Ltd., 1912.

*Nigeria and its Tin Fields.* By Albert F. Calvert. Crown 8vo. Pp. xvi + 488. *Price* 4*s.* 2*d.* London : Edward Stanford, 1912.

*The World* (Regional Geography). By J. B. Reynolds, B.A. Demy 8vo. Pp. vii + 360. *Price* 3*s.* 6*d.* London : Adam and Charles Black, 1912.

*A Lost Legionary in South Africa.* By Colonel G. Hamilton-Browne, "Maori Broune." Illustrated by S. Valda. Demy 8vo. Pp. xii + 308. *Price* 12*s.* 6*d. net.* London : T. Werner Laurie, 1912.

*Southern Italy and Sicily, with Excursions to Sardinia, Malta, and Corfu. Handbook for Travellers.* By Karl Baedeker. With 30 Maps and 34 Plans. Sixteenth Revised Edition. Pp. lvi + 508. *Price* 6*s. net.* Leipzig : Karl Baedeker, 1912.

*The Ridge of the White Waters (Witwatersrand), or Impressions of a Visit to Johannesburg, with some Notes of Durban, Delagoa Bay, and the Low Country.* By William Charles Scully. With 43 Illustrations in Half-tone. Crown 8vo. Pp. 264. *Price* 6*s. net.* London : Stanley Paul and Co., 1912.

*Monograph on the Sub-Oceanic Physiography of the North Atlantic Ocean.* By Edward Hull, M.A., LL.D., F.R.S. With a Chapter on the Sub-Oceanic Physical Features off the Coast of North America and the West Indian Islands, by Professor Joseph W. Winthorp Spencer, M.A., Ph.D. Demy Folio. Pp. 41. *Price* 21*s.* London : Edward Stanford, 1912.

*The County Directory of Scotland* (Decennial Issue), May 1912. Postally Edited by George Massie, as compiled by Arthur Giles, F.R.S.G.S. With Map of Scotland, reduced from the Ordnance Survey, specially prepared for the work by John Bartholomew and Co. Edinburgh : Arthur Giles, 1912.

*The Cornish Coast and Moors.* By A. G. Folliott-Stokes. Illustrations from Photographs by Alex. Begbie, John C. Douglas, and the Author. Crown 8vo. Pp. 367. *Price* 12*s.* 6*d. net.* London : Greening and Co., Ltd., 1912.

*Dans L'Atlantique.* Par Henri Delérain. Un volume in-16. 5 cartes. Pp. viii + 243. *Prix* 3 *fr.* 50. Paris : Hachette et Cie, 1912.

*The Junior Scientific Geography. The Atlantic Seaboard of North America.* By W. Ellis Heaton, B.Sc., F.G.S. Crown 8vo. Pp. 77. *Price* 10*s. net.* London : Ralph, Holland and Co., 1912.

*Britain in the Tropics*, 1527-1910. (*The English People Overseas.*) Vol. iv. By A. Wyatt Tilby. Demy 8vo. Pp. viii + 452. *Price* 6*s. net.* London : Constable and Co., Ltd., 1912.

*Langholm as it is. A History of Langholm and Eskdale from the Earliest Times.* By John Hyslop, J.P., and Robert Hyslop. Demy 8vo. Pp. xvi + 922. *Price* 7*s.* 6*d. net.* Sunderland : Hills and Co., 1912.

*Verkehrsgeographische Studien zu einer Isochronenkarte der Oesterreichisch-ungarischen Monarchie.* (Mit Kartenbeilage.) Von Dr. Franz Heiderich. Pp. 48. *Preis* 2 *Kronen* 40 *Heller.* Wein : Oesterr. Handelsmuseums, 1912.

*Tenth Report of the Geographic Board of Canada for the Year ending 30th June* 1911. Ottawa, 1912.

*Administration Report on the Railways in India for* 1911. Simla, 1912.

*Report on the Administration of Bengal*, 1910-1911. Calcutta, 1912.

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*United States Geological Survey, Washington, D.C.*

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# THE SCOTTISH GEOGRAPHICAL MAGAZINE.

## THE EXPLORATION OF THE SUDAN.[1]

By Col. Sir C. M. Watson, K.C.M.G., C.B., M.A., R.E.

The last occasion upon which the city of Dundee extended its hospitality to the members of the British Association was in 1867, forty-five years ago, and at that meeting the President of the Geographical Section was Sir Samuel Baker, who had then recently returned from his explorations on the Upper Nile, for which he had been awarded the Patron's Medal of the Royal Geographical Society, and which were of the greatest importance as regards that then little-known river.

In the Address which he gave to Section E, Sir Samuel Baker naturally referred at considerable length to the geography of the Sudan, and to the question of the sources of the Nile, which had been discovered a few years previously by Captain Speke and Captain Grant, when they visited the great lake, named by them the Victoria Nyanza, out of which flows the main branch of the river, the fertiliser of Egypt, which, after a course of more than 3500 miles, pours its waters into the Mediterranean. He also spoke of the second great lake, the Albert Nyanza, which he had himself discovered, after a long and very arduous journey, though, perhaps naturally, he did not dwell so much on what he had himself accomplished, as another speaker might have done. The words he spoke are well worth calling to remembrance, and, on reading them over, one is struck by the fact that hardly anything was then known of the country through which he travelled, but that, thanks to him and his predecessors, Speke and Grant, the first steps were taken which led to half a century of steady progress in geographical knowledge, until now the basin of the Upper Nile is fairly well known and fairly well mapped.

[1] The Presidential Address delivered to Section E (Geography) at the Dundee Meeting of the British Association, September 1912.

To-day I propose to take up the tale where Sir Samuel Baker had to stop, and to give a short *résumé* of the story of the Sudan since those days, more especially from the geographical point of view; but it will be necessary briefly to allude to its history also, for, in this case, as in all others, history and geography are closely united, and it is difficult to understand one without knowing something of the other.

There is a considerable amount of uncertainty in the minds of some people as to what the Sudan is, an uncertainty not without reason, as the word has an ethnological rather than a geographical meaning. The complete word, Balad-es-Sudan, is an Arabic expression for the country of the black people, and therefore includes, theoretically, all those parts of Africa which are inhabited by negro or negroid races. There has, however, been such a mingling of different races that it would be difficult to say to what part of the great continent the word Sudan should properly be applied. But, of recent years, changing from its original ethnological meaning, it has come to be regarded as the name of a more limited area; and perhaps the simplest definition is that it includes all the country watered by the Nile and its tributaries, as far north as the twentieth degree of latitude, and excluding the Sahara, and the basins of Lake Chad and the Congo on the west, and the districts watered by the river systems which terminate in the Red Sea and Indian Ocean on the east. Such a definition does not, of course, altogether agree with the existing political divisions, as it includes the eastern part of Abyssinia, Uganda, and part of the Congo State territory; but these divisions are in no sense geographical, whereas the basin of the Nile is a well-defined region which contains the greater portion of what may be regarded as the real Sudan.

There is one point as regards the geography of the Sudan which is remarkable and perhaps unique. In former times it was to a certain extent known, and, in the maps of Ptolemy, and of the Middle Ages, the great lakes, the ranges of mountains, and the rivers flowing from them, are indicated in a distinct, if not very accurate manner. But, owing to various causes, this geographical knowledge was completely lost, and the natural features disappeared from the maps. Look, for example, at Keith Johnston's Atlas, published in 1843, and you will see that there are no lakes shown, while the Nile to the south of 10° North latitude is indicated as an insignificant stream. The Sudan had relapsed into the position of a *terra incognita*, just as it had been in the days of Herodotus, and Ptolemy and the other ancient geographers were regarded as victims of their imaginations.

The revival of the knowledge of geography of the Sudan may be said to commence with the travels of James Bruce, who visited Abyssinia in 1770, explored Lake Tsana, and found what he believed to be the true source of the Nile in the River Abai, which ran into the lake from the south. He examined the place where the Blue Nile flowed out of Lake Tsana, but was not able to follow its course through the western mountains of Abyssinia, and rejoined it at Sennaar, about 220 miles above the junction with the White Nile. Travelling along the south bank of the Blue Nile, he crossed it at the ferry of El Efun, and then

went on to Halfaya, north of the site of the present town of Khartum, which at that time did not exist. Of the White Nile he says: "At half-past eight, about four miles further, we came to the village Wad Hogali. The River Abiad, which is larger than the Nile, joins it there. Still the Nile preserves the name of Bahr-el-Azrek, or the Blue River, which it got at Sennaar. The Abiad is a very deep river: it runs dead, and with little inclination: because, rising in latitudes where there are continual rains, it therefore suffers not the decrease the Nile does by the six months' dry weather." This is all he says of the White Nile, and he does not seem even to have taken the trouble to look at it, as he reports the point of junction of the two rivers as four miles north of Halfaya, whereas it is to the south of that place. He was so convinced that the Blue River was the one and only Nile that he regarded the investigation of the White Nile as unimportant, and shows it on his map as a comparatively insignificant river. Bruce's action in this matter is a warning to explorers not to neglect to examine something that does not fit in with their preconceived ideas.

At the time of Bruce's visit the origin of the White Nile seems to have been unknown to the inhabitants of the kingdom of Sennaar, a kingdom which had been established in 1504 by the Fung dynasty, which had taken possession of what had been the Christian kingdom of Alwah. Soba, the capital of Alwah, was abandoned, and a new town built at Sennaar, which was made the seat of government. The Fungs were partly of Arab and partly of negro descent, and their kingdom extended east of the Blue Nile to the foot of the Abyssinian Mountains, and westward as far as the White Nile, beyond which were the independent kingdoms of Kordofan and Darfur. At that time there appears to have been little or no traffic on the White Nile, and the marshes of the tenth degree, inhabited by the powerful Shilluk tribes, formed an impenetrable barrier to the south.

But, although after Bruce's expedition to Lake Tsana the majority of people seem to have accepted the Blue River as the true Nile, there were some wider-minded people who felt that there was a secret hidden behind the marsh barrier. One of these was a certain Mr. W. G. Browne, who made an interesting journey to Darfur in 1793, and who records in the account of his travels that he had the conviction that the river, of which Bruce had discovered the source, was not the true Nile, and that he considered it a matter of great importance that the course of the more western river, *i.e.* the White Nile, should be investigated, as he could not believe that its source was only two hundred leagues south of Sennaar.

Starting from Egypt, Browne travelled with a merchant's caravan from Assiut, by way of the oases of Khargeh and Selima, to El Fasher, in Darfur. Here he remained for three years, but was not able to do much in the way of exploration, as he was thwarted by the king and people, and was not allowed to go to Sennaar or to explore the White Nile. He collected, however, from the accounts given him by the natives, a good set of itineraries in Darfur and Kordofan, the first, so far as I know, compiled for the Sudan. But his efforts to obtain information as

to the source of the White Nile were not successful, and all he was able to learn was that ten days' journey south of a place called Abu Telfan, the Bahr-el-Abiad had its source in forty rivers, which came from the hills of Kumr. It seems probable that these numerous rivers were those that form the head-waters of the Bahr-el-Ghazal, and that the people of Darfur knew as little about the Bahr-el-Gebel, as the southern part of the White Nile is called, as the people of Sennaar.

But although Browne was not able himself to solve the mystery, his name should not be forgotten, as being one of the first in modern times to realise the fact that the White Nile was the longer of the two rivers. His views, however, seem to have met with no support, and Bruce was supposed to have settled the question of the sources of the Nile. The great lakes, shown by Ptolemy and the mediæval geographers, were, as I have already mentioned, erased from the map, and the White Nile was left in peace.

During the visit of Browne to Darfur the kingdom of Sennaar had fallen upon evil times, as an insurrection, which had commenced during the reign of Bady, ended with the death of King Adlan in 1789, when the Fung dynasty came to an end, and all authority fell into the hands of the tribal chiefs, who made and removed the kings of Sennaar at their pleasure. The internecine wars continued up to the time of the arrival of the Egyptians in the Sudan, and greatly facilitated the advance of the latter.

This advance of the Egyptians was due to the policy of Mahomed Ali Pasha, the Turkish Governor of Egypt, who had greatly increased his power by a successful campaign in Arabia in 1812-18, when he succeeded in capturing Mecca and Medina, and made himself master of the country. He then turned his attention to the Sudan, and decided to take advantage of the local troubles and to add Sennaar and Kordofan to the Egyptian dominions. In 1820 he sent an army up the Nile, under his son Ismail, who took possession of Dongola and the country adjacent to the river, as far as the junction of the Blue and White Niles, and, after seizing Sennaar, marched up the Blue Nile to Fazokl, on the Abyssinian frontier. Kordofan was also occupied, and the capital of the new Egyptian province was placed at Khartum, the point where the two Niles met, which took the place of the old capital of Sennaar; but no attempt was made to take possession of the country along the White Nile to more than about one hundred miles south of Khartum. So little was that river known beyond this that when Linant Pasha succeeded in sailing up the river as far as the island of Aba he was supposed to have arrived at the furthest point reached by a European since the first century.

No further advance was made for a few years, but, in 1838, Mahomed Ali decided to try to open up the White Nile, and an expedition under Major Selim, of the Egyptian army, succeeded in making its way through the marsh district, and in reaching a point about 6° 30′ North latitude on the Bahr-el-Gebel, while another expedition in 1842 got as far as Gondokoro. It was thus proved that the marshes were not impenetrable and trading-stations began to be opened up, both on the Bahr-el-Gebel

and the Bahr-el-Ghazal. On the former river, however, the traders could not at first proceed further than Gondokoro, as the rapids, which commenced a few miles south of that place, made navigation by sailing vessels impracticable, so the merchants had to establish their depots at Gondokoro and depend upon the natives bringing ivory from the south. To these natives the opening of the river proved a great evil, as the legitimate traders were soon followed by slave-hunters, who carried thousands into captivity, while killing many others. By the ill-will thus created the difficulty of exploration was increased. In the end, the source of the White Nile was discovered not from the north, but from the south, when Captain Speke, who, in company with Captain Burton, was exploring Central Africa from the east coast, heard of a great lake lying to the north, and succeeded in reaching the south end of the Victoria Nyanza in 1858. Convinced that he had found the long-desired source of the Nile, he started on another expedition, accompanied by Captain Grant, in 1860, and, after marching round the Victoria Lake, reached Gondokoro in 1863. Here he met Sir Samuel Baker, who had started from Khartum in 1862, in the hope of discovering the Nile sources. The information given by Speke and Grant showed that they had forestalled him; but he continued his journey, and in 1864 succeeded in reaching the Albert Nyanza, the second great lake from which the White Nile derives its water.

Thus, at length, after a lapse of many centuries, the truth of the statements made by Ptolemy and other ancient geographers was justified, and the lakes shown by them were restored to the map of Africa, while the White Nile was proved to be the real Nile, and the Blue Nile was relegated to the position of being the most important tributary.

During the period of the travels of Speke and Baker the slave-trade had been rapidly increasing, and the traders had practically taken possession of the country, and made themselves independent of the Egyptian authorities in Khartum. These slave-traders cared nothing for geography, and had matters remained as they were at that time, it is probable that a State hostile to Europeans would have been established, and all chance of further exploration would have been lost.

But in 1869 the Khedive Ismail, who had succeeded as ruler of Egypt in 1863, and had obtained largely increased powers from the Sultan, decided to restore his authority on the White Nile, and appointed Sir Samuel Baker as Governor of the country south of Gondokoro, with instructions to establish Egyptian rule as far as he could to the south of that point. But nature fought against Baker, and the difficulty of sailing up the White Nile had been enormously increased by the formation of the sudd, that strange vegetable barrier which at times completely closes the river channel, and he did not reach Gondokoro until two years had elapsed from the time of his departure from Khartum. There he hoisted the Egyptian flag, and then proceeded to occupy the country to the south. But he was not successful, as the force at his disposal was quite insufficient, and, though he established a few stations on the road from Gondokoro to Foweira, on the Upper Nile, little effective had been done when he returned to Gondokoro in April

1873. Neither was he able to do much in the way of geographical research, and, greatly to his regret, was unable to revisit the lake which he had discovered on his first journey.

In 1874 Colonel Gordon was appointed to succeed Baker, and, leaving Khartum in March, reached Gondokoro in twenty-four days, the sudd, fortunately for him, having been cut through by the Egyptian officials only a month before his arrival in the Sudan. Gordon ruled the equatorial provinces until October 1876, and during that time did much to tranquillise the country, as he had a remarkable influence over the natives. He moved the headquarters of the government from Gondokoro to Lado, and established a chain of posts along the Nile to Duflé, and thence to Nyamyongo, in Uganda, about eighty miles below the Ripon Falls. He also placed two steamers and two sailing-boats on the Albert Lake to facilitate communication. Gordon devoted much attention to the geography of the district, and prepared a map of the White Nile from Khartum to Urondogani, superior to any that had preceded it. This map included a plan of the Albert Nyanza, based on surveys made by Gessi and Mason, both of whom circumnavigated the lake. Mason reported the existence of the river, now called the Semliki, entering the lake from the south, but was unable to enter it, as the water was too shallow for his vessel.

Soon after his arrival at Gondokoro Gordon fully realised the difficulty of keeping up communication with Egypt by the Nile, and requested the Khedive to send an expedition to Formosa Bay, about a hundred miles north of Mombasa, on the east coast of Africa, with the view of opening up a road towards the Nile. The route he thought of was a little north of that now followed by the Uganda railway: but at the time he made the proposal the country was entirely unknown, and the difficulties would have been much greater than he anticipated. The idea, however, came to nothing, first, because the expedition was sent to the River Juba, on the border of Somaliland, which was much too far to the north, and, secondly, because it was ordered away by the British Government, which considered that it was encroaching on the territories of the Sultan of Zanzibar.

At the time that Gordon was establishing Egyptian authority in the equatorial provinces the Khedive's dominions were being extended by the conquest of Darfur, and the occupation of the province of Harrar, with its port at Zeila, in the Gulf of Aden. An excellent reconnaissance of Kordofan was carried out by Colonel Prout, of the United States Survey Department, in 1875, and a reconnaissance of Darfur was made by Colonel Purdy, another American in the Egyptian service, so that considerable additions were made at this period to the geographical knowledge of the Sudan.

But soon afterwards there was a serious setback to the Khedive Ismail's projects of conquest. Having acquired Massowah, Tajurra, and Zeila, on the Red Sea, he sent an expedition into Abyssinia in 1875, which was cut to pieces at Gundet, on the road to Adua, and another larger force sent in the following year was utterly defeated by the Abyssinians and had to retreat, with great loss, to Massowah. Some

surveys were made by the American officers on the staff of the Egyptian Army, but these expeditions did but little for geography, and their fate was the precursor of the destruction of Egyptian power in the Sudan.*

Colonel Gordon returned to Egypt in December 1876, and early in the following year was appointed Governor-General of the whole Sudan, a post he held for nearly three years, years of incessant labour, during which, much to his regret, he was able to do little for geography: as, though he travelled many thousands of miles through his vast territories, his whole time was occupied with questions of administration. He was wonderfully successful in his dealings with the inhabitants, and had he been left alone for a few years, the history of the Sudan would have been different: but he was constantly urged to send money to Cairo, money which he could not obtain without following the example of his predecessors and oppressing the inhabitants. This he would not do, and resigned in August 1879, when he was succeeded by an Egyptian Pasha, who revived the old bad customs of the country. His appointment led to the result that might have been anticipated, and in 1881 the revolt led by Mahomed Achmed, the Mahdi, broke out, and the Egyptians were driven out of the Sudan. Then the country was completely closed to Europeans, and nothing further could be done in the way of geographical discovery until the defeat of the rebels at Omdurman in 1898. Now, fortunately, peace is restored, a peace which, it may be hoped, will be a lasting one.

To geographers, of course, the existing state of affairs is very satisfactory, as it will undoubtedly lead to an increase in our knowledge of the Sudan and its resources. That knowledge is still very limited, much more so than many people are aware, and there are vast regions which still stand in need of careful examination. Maps, especially small scale maps, are misleading, and convey the impression that more is known than is really known. Take, for example, the case of the Blue Nile, one of the most important tributaries of the great river. Of this, the headwaters, Lake Tsana, first carefully examined by James Bruce, are fairly well known, and a good reconnaissance of this lake was made by Mr. C. Dupuis, of the Egyptian Irrigation Department, in 1903, a copy of whose interesting report is attached to the valuable Report on the Basin of the Nile, made by Sir W. Garstin in 1904.

The course of the Blue Nile from Famaka, on the Abyssinian frontier, to Khartum is also fairly well known, although not yet accurately surveyed. But of the river between Lake Tsana and Famaka, and of its course through the mountains of Abyssinia, our knowledge is most elementary, and it is doubtful whether the line, as marked upon maps, is correct. Here is a chance for a resolute explorer to distinguish himself by making a really good reconnaissance of this part of the river, and following it carefully from Lake Tsana to Famaka. But it would probably be rather an arduous task, and there would be many difficulties, natural and human, to overcome.

The question of the Blue Nile is only one of the many geographical problems to be solved in the Sudan. The upper waters of other tributaries, such as the Atbara, the Rahad, the Dinder, and the Sobat, and

the mountains from which they flow, are also little known, and will require years of exploration, while great areas of the level country of the Nile basin remain unvisited and unsurveyed. This can be well realised by any one reading Sir W. Garstin's excellent report already mentioned, in which he gives an admirable summary of the hydrography, and deals with the important question as to the manner in which the water of the different tributaries of the Nile can best be utilised for improving the agricultural capacity both of the Sudan and of Egypt. Among other projects with this object he proposes the cutting of an entirely new channel of more than two hundred miles in length, so as to allow the waters of the Bahr-el-Gebel to leave the existing channel at Bor, eighty miles north of Gondokoro, and to rejoin the Nile near the mouth of the Sobat below the sudd district; but, as he justly points out, the country through which this new channel would pass is practically unknown, as the whole of the area lying between the Bahr-el-Gebel, the Bahr-ez-Zaraf, and the Sobat is a *terra incognita*.

Sir W. Garstin points out that there is a great loss of water from the Bahr-el-Gebel between Gondokoro and Bor, for which he cannot account, and this is another point requiring to be investigated. Reading his remarks upon this subject reminds me of the time when I was assisting in General Gordon's survey of the Nile, when on this part of the river, at a point about fifty miles north of Gondokoro, I noticed a considerable branch leaving the Bahr-el-Gebel, and going apparently in a north-easterly direction. The native pilot told me that it was reported by the inhabitants to join the Sobat. It was impossible to investigate the truth of this statement, which, at the time, seemed rather doubtful, but it is interesting to note that a high authority like Sir W. Garstin records that the Nile loses a considerable volume of water near this place.

Whether the proposal of Sir W. Garstin to make this great canal will ever be carried out is doubtful; for my own part, I am inclined to think that, having regard to the amount of work to be done in the Sudan, it would be better to leave the Bahr-el-Gebel alone for the present. The cost of a canal such as that suggested would be very large, and if funds were available it would be better to spend them on a railway from the Sobat southwards. Sooner or later the railway, which now runs some distance south of Khartum to the point where it crosses the White Nile into Kordofan, will be extended, and in process of time will reach the Sobat. Meanwhile it might be worth while to select a point on the Sobat suitable for a bridge, and to make that point the northern terminus of a line of railway leading southwards to Gondokoro, and later, on to Uganda. Communication between Khartum and this terminus would, for the present, be kept up by the White Nile, which, with the exception of one or two places, is navigable for the whole year.

Looking at the question of the Sudan from the geographical point of view, there has been a wonderful increase of knowledge since the last meeting of the British Association in Dundee; but, on the other hand, there is a larger amount of work yet to be done before the whole of the vast area will have been satisfactorily surveyed, and it must be remem-

bered that the Sudan Government has claims of greater importance at present than that of carrying out a complete trigonometrical survey. But exploration will no doubt be carried on year by year, and the blank spaces on the map will gradually be filled up. Meanwhile we must wish Godspeed to the British officers in the Sudan, who are carrying out a great work of civilisation, and, at the same time, adding to the geographical knowledge of the world.

Leaving the Sudan, I would like to allude to a very important geographical undertaking which has made considerable progress during the past year. This is the production of the international Map of the World on the scale of $\frac{1}{1,000,000}$, a project which has been under the consideration of the leading geographers of the important countries for more than twenty years, since it was first proposed at the International Geographical Congress held at Berne in 1891. The question was discussed at succeeding Geographical Congresses, but did not take definite shape until the meeting held at Geneva in 1908, when a series of resolutions dealing with the subject was drawn up by a Committee composed of distinguished men of many nations, which was appointed to formulate rules for the production of the maps, so as to ensure that they should be prepared upon a uniform system.

These resolutions were approved at a general meeting of the Geneva Congress, and were forwarded by the Swiss Government to the British Government for consideration, whereupon the latter issued invitations to the Governments of Austria-Hungary, France, Germany, Japan, Russia, Italy, Spain, and the United States of North America, asking them to nominate delegates to act as the members of an International Committee to meet in London and debate the question. This Committee assembled at the Foreign Office in November 1909, and Colonel S. C. N. Grant, C.M.G., then Director-General of the British Ordnance Survey, was appointed President. The proceedings were opened by the Under-Secretary of State for Foreign Affairs, Sir Charles Hardinge, G.C.M.G., now Lord Hardinge, who, in his address, referred to the progress that had already been made with regard to the International Map, and expressed the hope, on behalf of the British Government, that the great undertaking might be brought to a satisfactory conclusion.

The main business before the Committee was to settle on the mode of execution of the map, especially as regards the size of the sheets, so as to ensure that adjacent sheets, published by different countries, should fit together; and also to settle upon the symbols, printing, and conventional signs to be used, in order that these should be uniform throughout. A series of resolutions, embodying the decisions arrived at concerning these various points, was approved and drawn up in English, French, and German, the first of these languages being taken as the authoritative text. As the map was to embrace the whole surface of the globe, the method of projection to be adopted was, of course, a very important consideration, and, after due deliberation, it was decided that a modified polyconic projection, with the meridians shown as straight lines, and with each sheet plotted independently on its central meridian, would prove the most satisfactory.

The surface of the sphere was divided into zones, each containing four degrees of latitude, commencing at the equator, and extending to 88° North, and 88° South latitude. There were thus twenty-two zones on each side of the equator, and these were distinguished by the letters A to V north, and A to V south. This fixed the height of each sheet. For the width of the sheets, the surface of the sphere was divided into sixty segments, each containing six degrees of longitude, and numbered consecutively from one to sixty, commencing at longitude 180°. This arrangement made each sheet contain six degrees of longitude by four degrees of latitude: but, as the width of the sheets diminished as they approached the poles, it was decided that, beyond 60° North, or 60° South, two or more sheets could be combined. Each sheet could thus be given a clear identification number defining its position on the surface of the globe, without it being necessary to mention the country included in it, or the latitude and longitude. For example, the sheet containing the central part of England is called North, N. 30.

In order to ensure that the execution of all the maps should be identical, a scheme of lettering and of conventional topographical signs was drawn up and attached to the resolutions; and it was decided that a scale of kilometres should be shown on each sheet, and also a scale of the national measure of length of the country concerned. As regards the representations of altitude it was arranged that contours should be shown at vertical intervals of a hundred metres, or at smaller intervals in the case of very flat, and larger in the case of steep ground, the height being measured from mean sea-level, as determined in the case of each country: while the levels of the surface of the country were to be indicated by a scale of colour tints, the colours being green from 0 to 300 metres, brown from 300 to 2500 metres, and purple above 2500 metres. In the same manner the depths of the ocean and of large lakes were to be indicated by varying tints of blue, so as to show intervals of 100 metres. In order to ensure uniformity in the scale of colours to be used, a copy of it, as approved by the Committee, was included in the plate of topographical symbols.

The whole scheme was thoroughly well worked out, and great credit is due to the members of the International Committee for the manner in which they carried out their difficult task. Since the meeting of the Committee in 1909 the preparation of the sheets, in accordance with the principles decided upon, has been taken in hand in several countries, and a number of these have been issued, which give a good idea of what this great map, the largest ever contemplated, will be like. These sheets deserve to be carefully studied, and will doubtless be the subject of considerable criticism, as there are several points which seem worthy of examination.

In the first place, it is for consideration whether it would not have been better if the colour scheme for representing differences of altitude had been omitted, as it is doubtful whether the advantage of the result gained is commensurate with the increased cost of printing the colours. And one naturally asks for what purpose is the map intended. Is it for the use of skilled geographers, of whom there are a comparatively small

number in each country, or is it for the instruction of ordinary people? If it is for the latter, it is to be feared that the colour scheme will give rise to erroneous impressions. Compare, for example, Sheet North, M 31, of France, with Sheet South, H 34, of part of South Africa. In the former, as the greater part of the country shown is less than 300 metres above the sea, the general colour of the sheet is green, while in the latter, as nearly the whole of the country included has an altitude of more than 300 metres, the map is for the most part brown. This to the less educated man will probably convey the idea that, while France is a fertile country, South Africa is a desert. The fact, too, that the darker tint of green represents the lower level and the lighter the higher, while, in the case of the brown, the lighter represents the lower and the darker the higher, and, in the case of the purple, the relative strength of the tints is again reversed, is rather confusing.

There is another point as regards the colour scheme which might be noticed, that is, that it is not the same on different sheets. For example, the scale of tints adopted in Sheet North, O 30 (Scotland), North, M 31 (France), and North, K 35 (Turkey), do not correspond. In the Scotch map the brown colour commences at an altitude of 200 metres, in the French at 300 metres, and in the Turkish at 400 metres. There may be some reason for this, but it appears not to be in accord with the resolutions of the Committee. Another reason for omitting the colour scheme for altitudes is that it might be better to keep colour work for other purposes, such as indicating political divisions, as there can be little doubt that so good a map as this, when completed, will be largely used for many purposes. It might be better that on a map of this small scale only the horizontal features, such as coastlines, river courses, railways, roads, and the position of towns should be shown, while to represent height graphically tends to obscure the former.

Another criticism I would venture to make is that the resolutions of the Committee appear to have been drawn up on the supposition that the whole world has been accurately surveyed, and no attempt seems to have been made to distinguish between those regions of which the maps are based on triangulation, such as England and parts of the continent of Europe, and the countries of which complete surveys have not yet been made. As the construction of the map proceeds and sheets are prepared of parts of the world our knowledge of which is imperfect, this want will become more pressing, but it is noticeable even with regard to the sheets already published. It is one of the evils of cartography that where anything is shown on a carefully engraved map it comes to be regarded as true, and, if it afterwards turns out to be erroneous, it is not easy to get it altered.

The scale of the map, $\frac{1}{1000000}$, appears to have been wisely chosen, as it is sufficiently large to give an adequate amount of detail, while, at the same time, the sheets will not be unduly numerous. Of course, for an international map a cadastral scale was essential, although for national maps a scale based upon the national system of measures is more convenient, as, for example, in the United Kingdom, where the scales of one inch and six inches to the mile are better than scales of $\frac{1}{500000}$ and

$\frac{1}{1000000}$ would have been. They are more suited for the majority of individuals, and an ordinary foot-rule can be used for measuring distances, instead of having to take them off with a pair of dividers from the printed scale on the map.

Looked at from the general point of view, there can be no doubt that the International Map is a most important and valuable undertaking. It is satisfactory that such a leading part in the matter has been taken by the British officers of the Royal Engineers and by the Royal Geographical Society.

In speaking of this map I have referred to the advisability, if not the necessity, of distinguishing between what is accurately and what is inaccurately known, and this brings me to another matter of considerable interest, the preparation of maps based upon the observations and information collected by explorers in unknown or little-known countries. To these explorers, some of whom have not been trained in geographical science, a large amount of detail shown upon modern maps is due, and it is only a small proportion of the land surface of the globe that has, up to the present, been surveyed in a scientific manner.

It is therefore of the greatest importance that the best value possible should be obtained from the work done by explorers, and this in the past has not always been sufficiently attended to, though during the last few years it is better understood. The people who stop at home in comfortable ease do not sufficiently realise the difficulties under which the conscientious traveller works and gathers together information about the country he passes through. Formerly, he generally had to work out his own observations and compile his own maps, but now conditions in this respect have greatly improved, and when he brings home his observations, notes, and sketches, he can hand them over to some body, such as the Royal Geographical Society, by whom they will be put in shape in a better manner than he could do it for himself. One has heard of an explorer in a little-known country sitting up all night after a hard day's work, working out his astronomical observations, and trying to put his rough surveys into shape. He would have done better to have gone to sleep and prepared himself by a good rest for the next day's journey. In fact, it would be better if an explorer never looked at the figures of an observation after he had recorded them, or read over the notes of his past work, confining himself to recording what he had actually seen day by day as accurately as circumstances permitted, and carefully distinguishing what he really saw from what he thought he had seen, or what he had heard.

It would be easy to adduce instances of the errors which have arisen from the neglect of such precautions. Perhaps one of the best known is that I have already alluded to, when James Bruce, a careful explorer, because he had made up his mind that the Blue Nile was the real Nile, passed the White Nile without taking the trouble to examine it, and recorded it as being a comparatively insignificant river. Then, there was the case of Sir Samuel Baker, who, having reached the shores of the Albert Nyanza with great difficulty, relied too much on what he was told by the natives, and showed it on his map as extending many miles

to the south of the equator. But great responsibility rests also upon those who have the task of compiling a map from the notes of an explorer, and the greatest care has to be taken to show only what is really known, and not what is uncertain. Geographers, whether in the field or in the drawing office, should always hold up before themselves a standard of accuracy higher than it is always easy to live up to.

Geography under its more ancient name of geometry is, of course, the mother of all sciences, although at the present time geometry has got a more narrow meaning, and is perhaps regarded by some as independent of geography, although really only a branch of it. The study of the earth upon which they lived was to the ancient nations the most important of all studies, and it is interesting to trace how astronomy, mathematics, geology, and ethnology are all so interspersed with geography that it is difficult to separate them. It is satisfactory to note how from the very first the British Association has always recognised the great importance of geography, since the first meeting of the Association at Oxford in 1832, when Sir Roderick Murchison, so well known to fame, acted as President of the Geographical and Geological Section. These two sciences remained united in the same section until the meeting at Edinburgh in 1850, when Sir R. Murchison was again the President. But, at the next meeting at Ipswich in 1851, they were separated, and while Geology remained as the subject of Section C, Geography, on account of its great importance, was made the subject of Section E, and the science of ethnology was united with it. Sir R. Murchison was the first President of the new Geographical Section, and was afterwards President no fewer than six times of Section E, showing the great importance attached by him to the study of the science of Geography. May I express the hope that the Presidents of the Section will endeavour in future to follow, however humbly, in the footsteps of that leader of science.

## A COMPARISON OF THE CLIMATE OF EDINBURGH AND BOURNEMOUTH.[1]

By Ralph Richardson, F.R.S.E.

(*With explanatory Diagrams.*)

The accompanying diagrams (pp. 521 and 523) have been prepared from the annual records published respectively by the Royal Observatory, Blackford Hill, Edinburgh, and by Mr. Charles Dales, F.R.Met.Soc., Meteorological Registrar to the County Borough of Bournemouth.

They are interesting as exhibiting two entirely different examples of British climate, one represented by a city on the eastern coast of Scotland largely influenced by its proximity to the North Sea, and

[1] Read before the Scottish Meteorological Society at its meeting in Edinburgh on 12th December 1911.

the other by a town on the south coast of England influenced by the English Channel.

I am fully aware that, for a thoroughly exhaustive comparison of the climates of Edinburgh and Bournemouth, one would require to examine and tabulate data for a period not merely of five but perhaps of fifty years: but I have had neither time nor opportunity for such prolonged research. I therefore offer the present Paper as a preliminary survey of the weather at the two places, founded on reliable official statistics for the past five years. I have been indebted to the Secretary of the Scottish Meteorological Society (Mr. A. Watt) for a summary of the Reports of the Royal Observatory, Edinburgh, and to Mr. Dales for his Reports as Meteorologist to the Town Council of Bournemouth.

I may add that while the Edinburgh data were obtained at the Royal Observatory at a height of 440 feet above the sea-level, the recording instruments at Bournemouth were respectively: Rain Gauge 145 feet; Barometer 165 feet; and Sunshine Recorder 170 feet, above the sea.

Edinburgh and Bournemouth are popularly considered to stand at the poles apart as regards climate, the former having been condemned climatically so often as to have passed into a byword, while the climate of Bournemouth has been extolled so much that it is universally believed to be ideal.

Thus, when Tennyson visited Edinburgh in 1853, he tried to forget the severity of its climate by recalling that of Italy, and described his feelings as follows:—

> "And I forgot the clouded Forth,
> The gloom that saddens Heaven and Earth,
> The bitter east, the misty summer,
> And gray metropolis of the North."[1]

Very different language is used by the Borough Meteorologist Mr. Dales in describing the climate of Bournemouth. He tells us that "Bournemouth in 1905 held the first position in regard to the number of hours of registered sunshine for the south coast, when we recorded 1818·6 hours. In 1906 we recorded 1970·1." Again, in 1907, he says, "Taking our climatic conditions as a whole, they were superior to those not only of other parts of the United Kingdom, but of the Continent." In 1908 he becomes axiomatic, and declares that that year "bears out the well-known axiom—Bournemouth is warm in winter, and cool in summer." In 1909 he finds that, "taking the weather of Bournemouth for the whole year, it certainly compares most favourably with any other part of the kingdom from which we get authentic reports"; a statement which he repeats in his summary for 1910, adding "It may truly be said that for the thirty-four years during which records of the weather have been taken here, there have not been more than two or three Christmas days on which the sun has not shone brightly. We had 20 hours bright sunshine the last week in December 1910."

All this must be very agreeable reading for the people of Bourne-

[1] *The Daisy.*

mouth. Unfortunately we have no official in Edinburgh to bring out the good points of its climate, if indeed there are any. On the contrary, there is a universal tendency to depreciate it, not merely on the part of visitors, but also even of its own citizens.

One of its most gifted sons, Robert Louis Stevenson, left Edinburgh after uttering a wild denunciation of its climate. "Edinburgh," he wrote,[1] "pays cruelly for her high seat in one of the vilest climates under heaven. She is liable to be beaten upon by all the winds that blow, to be drenched with rain, to be buried in cold sea-fogs out of the east, and powdered with the snow as it comes flying southward from the Highland hills. The weather is raw and boisterous in winter, shifty and ungenial in summer, and a downright meteorological purgatory in spring. The delicate die early, and I, as a survivor, among bleak winds and plumping rain, have been sometimes tempted to envy them their fate. For all who love shelter and the blessings of the sun, who hate dark weather and perpetual tilting against squalls, there could scarcely be found a more unhomely and harassing place of residence. . . ." And yet he adds, "the place establishes an interest in people's hearts: go where they will, they find no city of the same distinction: go where they will, they take a pride in their old home."

As Stevenson was not merely a member of the Scottish Meteorological Society, but had read a paper before it on "Local Conditions affecting Climate,"[2] we may believe that he did not characterise spring-time in Edinburgh as a "meteorological purgatory," and that he did not denounce its weather in summer and winter, without having systematically observed it. So that the charge Stevenson brings against the climate of Edinburgh is a much more serious one than if it had been delivered by an uninformed person, for it is levelled by one who not only spoke from his own personal experience, but by one who had contributed meteorological papers both to this Society and to the Royal Society of Edinburgh.[3]

However unwillingly, we must regretfully and frankly admit that one of the few members of the Scottish Meteorological Society who has attained world-wide fame published to the world his opinion—an opinion which has done our city much harm in the eyes of strangers—that Edinburgh, his beloved native city, which in other respects he considered was a city unequalled in the world, possessed "one of the vilest climates under heaven."

It is interesting to note that, not long after leaving Edinburgh, Stevenson resided at Bournemouth for three years (1884-7), during which period, judging from his *Letters*,[4] he formed an unfavourable opinion of its climate. The truth is, that he was too confirmed an invalid to suit British weather, whether in Edinburgh or Bournemouth, and fitly

[1] *Edinburgh. Picturesque Notes*, new edition, London, 1890.

[2] This paper was not printed.

[3] Stevenson read before the Royal Society of Edinburgh on 19th May 1873 a paper on the 'Thermal Influence of Forests."—*Proceedings of the Royal Society of Edinburgh*, vol. viii., pp. 114-25, and in the "Edinburgh Edition," 1898, of Stevenson's works in appendix.

[4] New edition in 4 vols. London, 1911.

closed his splendid literary career amid the palm-groves and eternal sunshine of Polynesia.

Our forefathers (a robust race) do not seem to have had any fault to find with the weather of Edinburgh. Turning to the well-known *History of Edinburgh*[1] by Hugo Arnot, Advocate, we find him declaring in 1779 that Edinburgh was "as healthful as most towns in Britain, and more so than any of equal bulk. Its situation is elevated; it is not near any stagnant waters; and its neighbourhood to the sea not only renders the air more salubrious, but gives the opportunity of sea-bathing to people of all ranks. The climate is temperate; neither rains nor drought are excessive; and the great violence of the winds tends to dissipate any noxious vapours."

A distinguished member of Arnot's profession, and who has long resided in Edinburgh, has quite recently championed Edinburgh, not merely as a pleasant and healthful residence for human beings, but also as possessing a climate suitable for a zoological garden stocked with animals accustomed to tropical conditions.

Addressing the last annual business meeting of the Zoological Society of Scotland, its president, Lord Salvesen, assured his hearers, from personal knowledge, "that the climate of Hamburg" (where there is a fine zoological garden) "is very much worse in winter than that of Edinburgh; and that fogs in Hamburg are more numerous than those of Edinburgh; with more rain and unpleasant easterly winds than they even had in Edinburgh." Stevenson's anathema on Edinburgh for having "one of the vilest climates under heaven" is mitigated by Lord Salvesen's remark that, when he visited New York last spring, "the natives described their climate as the worst in the world."

Our great meteorologist Dr. Buchan remarked that "when a winter climate is sought offering in the highest degree the combined qualities of mildness and dryness, it is to be found on the English Channel from about Dover to Portland." Of course this includes Bournemouth.

What then are the general results derived from an inspection of the diagrams which accompany this paper?

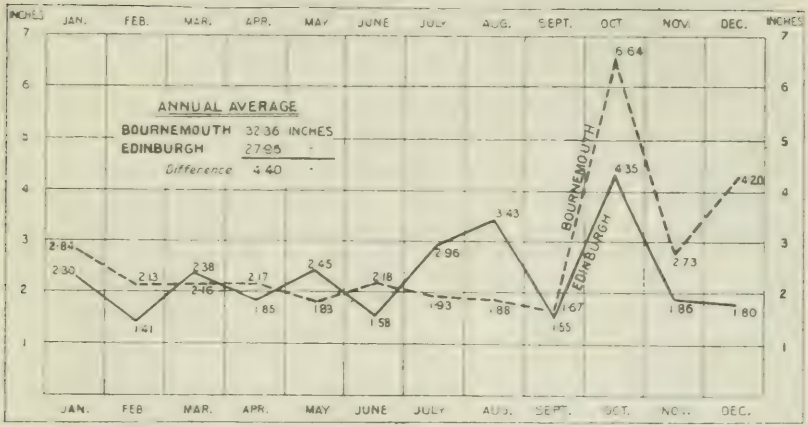
Take first of all the comparative mean *Temperatures* of Edinburgh and Bournemouth for the five last years, from 1906 to 1910 inclusive. We learn that the temperature of Bournemouth during the first three months of the year was less than 3° above that of Edinburgh (with a little over 3° in April), but, when we come to May, the temperature of Bournemouth exceeded that of Edinburgh by 5° and continued at over 4° (in August 5°) till the end of the year. We find from the average of the past five years that the climate of Bournemouth is annually 4° warmer than that of Edinburgh.

Take next *Rainfall*. The excess in this case is not on the side of Edinburgh, but on that of Bournemouth. The wettest averages in Edinburgh for the past five years were during the months of August (3·43 ins.) and October (4·35 ins.). The wettest averages for Bournemouth were during the months of October (6·64 ins.) and December

[1] Original edition of 1779, page 333.

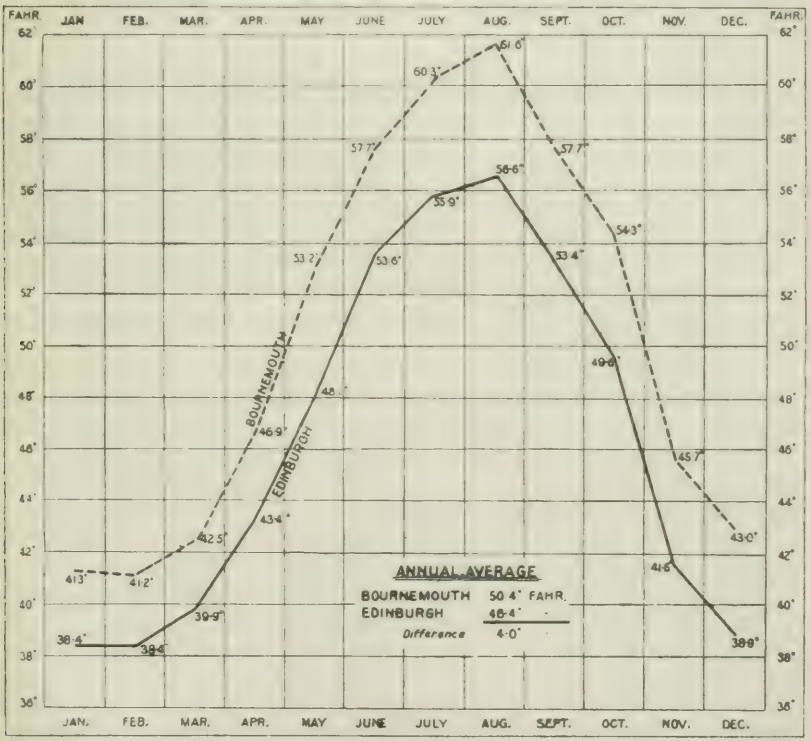
## EDINBURGH & BOURNEMOUTH AVERAGE RAINFALL

FROM 1906 TO 1910 INCLUSIVE


INCHES
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
ANNUAL AVERAGE
BOURNEMOUTH 32.36 INCHES
EDINBURGH 27.95 "
Difference 4.40 "
BOURNEMOUTH
EDINBURGH
2·84 2·30 2·13 2·38 2·16 2·17 1·85 2·45 1·83 2·18 1·58 2·96 1·93 3·43 1·88 1·67 1·55 6·64 4·35 2·73 1·86 4·20 1·80

## EDINBURGH & BOURNEMOUTH MEAN TEMPERATURES

FROM 1906 TO 1910 INCLUSIVE


FAHR.
JAN FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
ANNUAL AVERAGE
BOURNEMOUTH 50.4° FAHR.
EDINBURGH 46.4° "
Difference 4.0°
BOURNEMOUTH
EDINBURGH
41·3° 41·2° 42·5° 46·9° 53·2° 57·7° 60·3° 61·6° 57·7° 54·3° 45·7° 43·0°
38·4° 38·4° 39·9° 43·4° 48° 53·6° 55·9° 56·6° 53·4° 49·8° 41·6° 38·8°

(4·20 ins.). The annual excess of rainfall at Bournemouth over that of Edinburgh averaged 4·40 ins. during the past five years. There was on an average throughout the year nearly one inch more rain in Bournemouth than in Edinburgh. During July and August there was more than an inch; during October and December there were more than two inches more rain at Bournemouth than at Edinburgh.

Meeting Mr. Dales at Bournemouth last June, I asked him whether he could account for the exceptionally heavy rainfall habitually experienced there during the month of October, but he could offer no explanation. I pointed out that the rainfall at Bournemouth for October 1907 was actually 10·97, whereas at Edinburgh it was 7·53, also an unusually heavy fall for that month. On examining the prevalent winds at Bournemouth given in Mr. Dale's printed records for October, I observed that in 1904 northerly winds were prevalent, in 1906 northerly and westerly winds, and in 1907 westerly winds. I have not found the records of winds stated for other Octobers, but I notice that during that month in 1904, 1906, and 1909, there were no gales or storms. Mr. Dales tells me that the prevalent winds there are northerly, and that their warmest wind is sometimes from the north-east.

It is a curious coincidence that during the past five years, both in Edinburgh and Bournemouth, October had the highest rainfall average, but whereas at Bournemouth the average October rainfall was 6·64, at Edinburgh it was only 4·35.

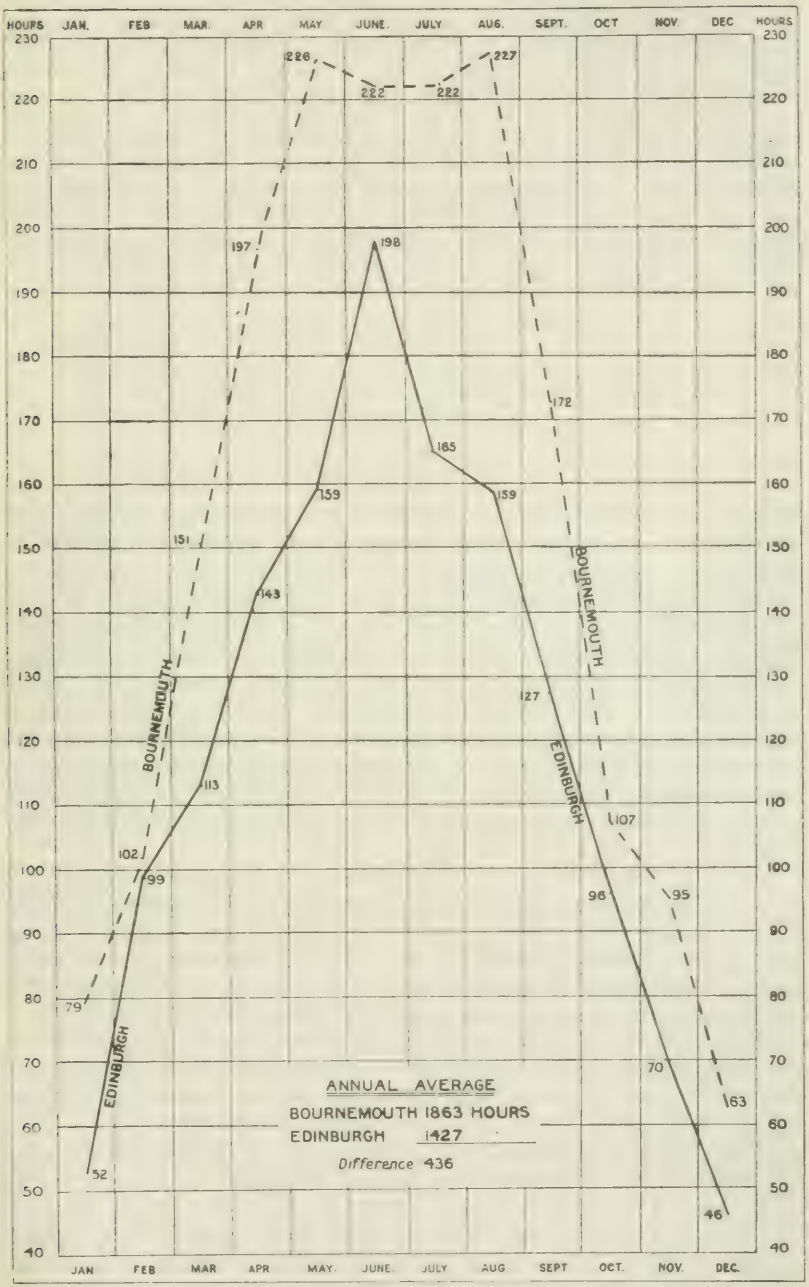
Lastly, let us look at their respective records of *Sunshine*. Bournemouth has long been regarded as an English Heliopolis, and my diagrams certainly bear this out. For the period under review, namely, the last five years, Bournemouth had throughout the whole year an average of 436 hours more sunshine than Edinburgh. The only months during which the two towns approximated were February, when Bournemouth was only 3 hours ahead of Edinburgh, October 11 hours, and December 17 hours. During all the other months, Bournemouth was far ahead, viz.: in January 27 hours, March 38 hours, April 54 hours, May 67 hours, June 24 hours, July 57 hours, August 68 hours, September 45 hours, and November 25 hours.

However, if the climate of a locality in Britain is to be tested by perhaps the most trying British month, *February*, it does not follow that a person will escape its rigour by leaving Edinburgh and going to Bournemouth. We find, on the averages of the past five years, that localities so widely apart as Edinburgh and Bournemouth do not during February differ so very much after all.

Suppose a person were to visit first Edinburgh and then Bournemouth during February, what would his climatic experiences probably be? He would find Edinburgh between 2° and 3° colder than Bournemouth (38·4 and 41·2 were their respective mean temperatures in February for the past five years). He would find Bournemouth with about ¾ of an inch more rain (2·13 at Bournemouth, and 1·41 at Edinburgh). Finally, he would enjoy only 3 hours more sunshine during February at Bournemouth than at Edinburgh (102 hours at the former, and 99 at the latter).

## EDINBURGH & BOURNEMOUTH AVERAGE SUNSHINE

FROM 1906 TO 1910 INCLUSIVE



For the much abused "gray metropolis of the North" is by no means destitute of sunshine. On the averages of the past five years we had 1427 hours of sunshine every year. While Bournemouth's sunniest months were May (226 hours) and August (227 hours), Edinburgh's sunniest month was June (198 hours).

Then we must keep in mind the greater length of the day in summer in Edinburgh as compared with Bournemouth, enabling crops to ripen in Scotland quite as well as in the south of England. On an average, the day at Edinburgh in June is 53 minutes, in July 48 minutes, and in August 27 minutes longer than in London. Therefore, though in summer we may not have so much sunshine as at Bournemouth, we have longer daylight; and some would prefer the latter to the former

## THE USE OF STATISTICS IN THE TEACHING OF GEOGRAPHY.

By B. C. Wallis.

There are two terms in use in discussions on the teaching of geography of which it is specially desirable that the precise meaning should be made quite clear. These are "statistics" and "practical work." By statistics is here meant the quantitative expression of geographical facts in their corresponding units, *e.g.* the annual quantity of coal mined in the United Kingdom is roughly 250,000,000 tons. Practical work in geography refers to school exercises in which the pupil is set either to do a definite piece of outdoor work, such as a plane table survey, or to perform an exercise dealing with a set of geographical facts, and to investigate the relationship between these facts and other facts previously examined in similar fashion—the essence of the work being that the pupil obeys certain instructions and attempts to arrive at definite conclusions for himself.

Now, in regard to each of these matters, the teacher is faced by a preliminary question. Does he plan to make use in geography of the heuristic method of instruction, which has been found so useful in the teaching of physical science, and, also, is it his intention to use quantitative expressions of geographical facts merely as illustrations of tendencies or as an essential expression of geographical truth?

Take first the question regarding the heuristic method in its relation to practical work. The map is the ultimate synthesis of the subject-matter of geography, the pupil must be able to read maps. Consequently the teacher has to decide the extent to which he will train his pupils by allowing them to make simple maps of the kind which they are called upon to understand. He has to decide, in relation to the limitations of his own particular work, the degree to which the pupil may be called upon to make maps before reading them. When he has come to a decision on this point, he has further to decide whether the pupil shall make such maps in direct conjunction with himself, *e.g.* the

whole class attends to the making of one map on a blackboard or on a large sheet of paper, each boy helping to do some part of the work, or whether the boys shall each attempt to make a map from data which he provides, *i.e.* whether the work shall be a practical exercise. In either case the data used will in some cases be quantitative, *e.g.* a rainfall map; and in this connection the teacher has to decide on a second question: Are the conclusions to which the map leads to be expressed in relation to quantities, or are they to be limited to the use of words which may imply *more* or *less*, but not *how much more* or *how much less*?

It is the purpose of this paper to suggest that the teacher should focus attention upon these matters of *how much more* and *how much less*, and to imply that in so doing the teaching should be, especially in the early stages, heuristic in character. It is suggested that the pupil should not only know how to read maps, but also should appreciate some of the difficulties attendant upon the expression of geographical fact in the form of a map; some of the limitations to which maps are subject, more especially those maps which show climate and distributions. It is further suggested that occasionally the pupil should be set an exercise which involves the checking of a current geographical generalisation, so that he may appreciate the relation of the generalisation to the data upon which it is based.

Before entering into details, it will perhaps be advisable to clear away possible misunderstanding by a precise statement of the writer's point of view on certain matters. First of all, in regard to the human element in teaching geography. The main matter for the pupil is the description of the life of man under the varying circumstances in which he finds himself on the earth. In the early stages the teacher is compelled to describe, in language suited to the child's intelligence, the striking contrasts which such a world survey provides. He naturally emphasises the share which man in different climes has in the work of the world, and from this he may develop the quantitative expression of this work. He passes to the consideration of, for example, the life of the sheep-rearer in different lands, and he reviews possibly the picturesque varieties of a shepherd's life. But the shepherd of Central Asia loses importance when compared with the sheep-farmer in the Argentine or on the Australian Downs, because his work is so limited in purpose that he does not share in the larger work of the world, his outlook is limited to his immediate surroundings, and hence the teacher passes naturally to the question of the distribution of sheep in the world. He begins to deal with quantities, with numbers of sheep, and with their concomitants, quantity of wool and meat produced. Here attention is focussed, and work is done regarding the number of sheep per square mile, the number of tons of wool or mutton supplied, etc. And, in consequence, the teacher must be on his guard that the pupil is not allowed to forget the fact that in measuring the number of sheep and the amount of their produce he is attempting to assess the work of the men who rear these sheep. For convenience we study sheep and wool and mutton, because we cannot easily find better means of studying in a comparative way the life of the men. The same care is required in relation to the map and

to the printed page of the text-book. It is part of the pupil's training that he should regard the map showing sheep distribution, the tables of quantitative information in his text-book, as expressions of the work of the sheep-rearer; and, when the pupil has learnt something regarding the *how much more* or the *how much less*, he is led onwards to the consideration of the human note with specific reference to the question *why* so much more or less.

In the second place, we should consider a gap in our teaching which quantitative methods in geography can fill. It has long been a standing reproach that no effort is systematically made in schools to prepare the pupil for later life by teaching him how to discuss and appreciate the constant numerical appeals to his intelligence which face him then both as a worker and as a citizen. Prospectuses of business concerns, and their annual reports, political pamphlets and discussions, monographs and articles on social reform, even the illustrated magazine and the advertisement, call his attention to facts expressed in quantities. It is one of the signs of the times that this method of presentation is more extensively used than in years gone by; yet we teachers have rarely attempted to make any preparation towards the understanding of documents of this type, although they appeal, in many cases, very closely to the later intellectual life of our pupils. There has been a gap in our system. By means of mathematics we train the pupil to think quantitatively, numerical relations of a more or less ideal kind becoming patent to his growing facility in that subject. By work in physical science we train him to precision of measurement, to the application of these numerical ideas to small amounts of concrete things. We provide an excellent training in dealing with the comparatively microscopic forms of measurement; yet we leave him there; only haphazard and by chance does the pupil learn anything of measurements at the other end of the scale, of the degree of accuracy to which such measurements are subject, of the ways in which large masses may be described so as to be intelligible, of the means of investigation which are applicable to problems of an economic kind where the flux of circumstance appears to render measurement impossible. A gradual course of training in quantitative measurements in geography tends to remove this reproach, tends to round off the equipment of our pupils and to make them better citizens, less liable to be impressed by the mere magnitude of things on a large scale.

This idea leads to a third point: Is there sufficient constancy in the production of any commodity to enable measurements of it to be made? The reply to this question is in the affirmative for the majority of commodities, and this constancy is assumed as a basis of the exercises in commercial geography which are enumerated later; and even where this constancy does not appear, this fact provides additional matter for geographical thought.[1]

Fourthly, it may be pointed out that the constant appeal to quantities acts as a useful corrective upon the frequent misapprehensions which

[1] The reader may be referred for a fuller discussion of this subject to papers by the present writer in the *Geographical Journal* for January and August of this year.

almost necessarily follow the use of words only, *e.g.* sea-island cotton has some importance; it would be possible from some of the text-books which are provided for use in schools for the pupils to imagine that this variety is of outstanding importance: such an assumption might unconsciously arise from the mere mention of this variety in a sentence in the text; it would be possible to quote such sentences which are unconsciously misleading because the geographical fact is expressed in words only. The quotation of the numerical fact in the same sentence would prevent such misapprehension.

Finally, it must be asserted that quantitative geography does not imply the banishment of descriptive geography, it implies for certain departments of the work precise description by the pupil instead of more or less loose description by the teacher. It presupposes that each teacher will make just as much use of it as a method as both he and his pupils find valuable. Some minds lack facility regarding numbers, for them the quantitative results with some preliminary lessons on the methods by which they are obtained will suffice. In any case, each teacher is the best judge of the degree to which he can apply the quantitative method with his class, and when he finds that it makes for facility, for accuracy, for intelligent and comprehensive outlook, then will he extend its use.

First ideas of quantitative work arise most naturally in regard to climatic data. The pupil first of all makes some measurements of some concrete reality which is before him, the actual quantity of rain which falls, the actual up or down movement of the mercury in a barometer or thermometer. He learns the customary method of recording such movements, and becomes acquainted with the universal "shorthand" descriptions of these measured quantities. Temperature and rainfall immediately present two variant interpretations of the meaning of means and averages: he finds that mean daily, monthly, and annual temperatures are similar to mean pressures, since they are average of means, but differ from means for rainfall and sunshine, which are averages of totals. He is introduced to the map method of recording such means, he is provided with tabulated data and attempts to make such a map for himself. According to the ability which he manifests he is called upon to make one or more maps of the same kind for temperature, or rainfall, etc., but so soon as he can appreciate such maps then he need make no more, he need but read and study the standard maps of his atlas. He has begun to handle statistics, but his education should not stop at this point. Later in his school life, at times when his mathematical development justifies the attempt, he is called upon to study the methods and work which lie behind the tabulated data and the standard maps. One exercise consists in an examination of the range within which a climatic average lies. For example, consider the rainfall of Greenwich for thirty years. The final annual average for this period is 23 inches, but individual years in the series may have had a rainfall as much as 50 per cent. above or 25 per cent. below this. He argues from this that there is no need of greater refinement than the whole number in the 23—in fact, tenths of an inch may be disregarded; and further, he concludes that there is no

need to attach great importance to the figure 3, for the number 23 is an approximate value, and since the isohyets on the standard maps are drawn in relation to averages so obtained, he will agree that there is no finality about their position, that they have not the same precision as may be attached to the contours of an Ordnance Survey map. It will be possible to show him rainfall maps for the British Isles, say, which illustrate this point, especially in regard to the position of the annual isohyet of 30 inches in Cheshire. He will appreciate more completely the value of the isohyets for, say, the Sahara, or for new countries such as New Zealand. He will learn, from this and similar exercises, caution in dealing with such maps, and will regard with some apprehension rainfall maps for the north of France, say, where the monthly averages are shown by isohyets based upon a twenty-year period, to which are attached many pages of text containing deductions based upon such insufficient data. To the teacher who suggests that refinements such as these are too subtle for his pupils, it may be urged that some suggestion of caution is necessary, as he is not preparing merely for to-morrow, but for the whole of the pupils' lives, and that if he makes his pupils use rainfall maps, then as they become sufficiently old and intelligent to appreciate the distinction, it is his business to point out some of the drawbacks attendant upon the use of such maps, and to dispel the idea which pupils at first attain, that because such and such a line is printed in an atlas it has the lasting qualities of the pyramids and the stability commonly attributed to "the laws of the Medes and Persians."

A useful exercise at a late stage would be to ask the pupils to find the evidence which justifies the generalisation that the cotton industry of south-east Lancashire benefits largely by the humidity of the atmosphere on the western flank of the Southern Pennines.

Statistical tables may be used to determine seasonal percentages of rainfall or the mean range of temperature for various parts of the earth's surface, and this work leads to a very useful form of test, in which the pupils are supplied with rainfall and temperature data for the several months of the year for places A, B, etc., and asked to deduce therefrom, as well as they can, the locality of A and B.

It is at the option of the teacher to introduce his pupils to the first-hand sources of the statistical tables by letting them perform exercises upon the daily and other weather reports, or by showing them copies, for example, of "British Rainfall." A useful study from such sources may be made of the climatic elements of New Zealand, beginning with the wind directions and passing from the construction of wind roses to the mapping of isohyets and isotherms, etc. These exercises would introduce them to the best extant example of an insular climate. Such a development of method and so detailed an investigation into facts as has been outlined would be spread over the whole geography course, and would inspire and illuminate similar work in other departments.

The next great geographical department which is capable of quantitative treatment is that of production, usually described by means of distribution maps. The pupil begins by the consideration of wheat-

growing in the British Isles. He is supplied with data showing the average yield of wheat per acre in Great Britain. From this he makes a map to show the counties which have an excellent and those which have a good yield; he thus learns one aspect of the work of a British farmer. Later, he considers the yield of wheat per county in relation to the area of the county; he calculates, or has calculated for him, the average yield in bushels per 1000 acres or per square mile. He maps his results, and marks on his map the great wheat-growing area in the eastern counties. By comparison with his first map he learns that a good yield per acre may be obtained by a farmer who sows only a small quantity of seed in a carefully selected field, and thus he appreciates the difference between the two kinds of map. The conclusions which he is asked to draw from his own work depend upon comparisons between the maps he has made and the standard orographical and climate maps, which he is by this time experienced in reading. Other farming products are treated in the same way, and he is thus prepared for the interpretation of the distribution maps which he finds in his atlas. He is led from such exercises to a world-distribution map in which are synthesised small maps for the several countries of the world, and he is ready to draw his own conclusions from a comparison between world-distribution and world-climate maps. He may be introduced to first-hand sources by using, perchance, the reports of the Agricultural Census of New Zealand. From this source he may make maps showing the extent of wheat-growing and sheep-rearing in New Zealand, and so may compare that country with Great Britain. Work of this nature gives him a first introduction to the necessity for making averages over a short period of years to get rid of the sudden fluctuations which may occur in the production of a country in consequence of the fluctuations of the climate and of the needs of the farmers.

The pupil will ultimately be led by his work to a grasp of the inter-dependence of the countries of the world, and this may be fixed very precisely by an exercise such as the following:—the production of wheat in New Zealand has fluctuated very greatly: the New Zealand "blue-books" will supply data showing this fluctuation as well as the fluctuation in the quantities of wheat exported to Australia, etc. When these are compared with the data for wheat production in the whole world, the pupil will find that the New Zealand farmer sowed wheat for export in the years of maximum production, and that in certain years a good harvest of wheat all over the rest of the world caused a falling off in the demand for his wheat, so that much of it was unsaleable. The next year he sowed a much smaller quantity, and this was reflected as one of the violent fluctuations in the total wheat production in New Zealand.

One example of the way in which the human element can be kept prominently before the pupil arises in the case of new countries such as New Zealand and the Argentine; from the census results he may prepare population maps as well as maps showing the density of farm production, and thus learn the intimate relation between man and his work.

A statistical exercise of some importance arises in connection with the following:—the pupil reads in his text-book about the wheat, maize, tobacco, and cotton belts in the United States; he refers to his atlas where he finds them marked. He may be asked to investigate these maps and check their accuracy, but he should certainly be asked to find if there be any similarity of belt-like distribution in Western Europe to compare with this. He is supplied with data regarding the departments of France, and similar subdivisions of Germany, Holland, and Belgium. He maps wheat, tobacco—and, while he has the data handy, other farm products—and finds that roughly in the Eastern Atlantic coast-lands there are wheat, tobacco, and, if we include Egypt for the moment, cotton belts which correspond with those of the western shores of the same ocean.[1]

The teacher then proceeds further, and considers the total product of the western belts in comparison with the total product of the eastern belts expressed as percentages of the world's production of that article, and reasons for the difference are deduced. This exercise forms an excellent introduction to two matters: first, the difference between mixed and prairie farming, and secondly, the fact that in the case of Western Europe the predominantly manufacturing work of a large bulk of the population tends to obscure the very important farming work.

The geographical course contains exercises upon production of as many kinds of commodities as there exist convenient quantitative data, in as great detail as time permits, due regard being paid to the importance of the commodity for the world's food or industry. Among the articles of which the districts of production are described will be found some such as minerals and manufactured articles for which it is impossible to obtain satisfactory data regarding quantities produced. For these we have to fall back upon a secondary means of investigation; we are compelled to pay attention to the amount of such produce exported by the country in question, and in each case we have to ask ourselves to estimate the probable ratio between the total output and the total export. Such considerations lead to the question of trade, and since it is manifestly impossible to deal with the traffic of the whole of the world in detail, attention is concentrated upon the traffic of our own islands. Some attempt has been previously made, for example, to assess the world production of sugar and the shares of the various countries therein; the next step lies in the acquisition of the numerical facts as to those countries in the list of producers who send supplies to the United Kingdom. These are marked upon the distribution map. Such a result always implies attention to the relation between the quantity of the commodity produced in our own islands and also to the quantity of the imports which are re-exported. At the same time, in the case of certain articles, it is geographically useful to carry the inquiry further and to discover why certain big producers do not send us supplies, and

[1] It is understood throughout in cases where the teacher cannot find time for his pupils to work out these quantitative results for themselves, either singly or by class co-operation, that he makes the maps and discusses with them the sources of the data and the details of the construction of the maps.

further where their produce is consumed. For example, in the case of sugar, it is found that Germany and India are the two chief producers of sugar, and that we receive most of our sugar from Germany, and practically none from India: here the pupil is faced with the questions why do we not receive sugar from India, where is the Indian sugar consumed? This last question sends him to the tabulated statistics of the exports from our Indian Empire with an added zest. In such ways the early ideas of traffic are obtained: in each case in relation to some special commodity, about the production of which something has already been learnt.

In all the work on production and trade so far suggested the pupil has usually had his data provided ready for his work: but it will perhaps be wise if the teacher at this point introduces some of the regular sources of statistical information: he can use the "blue-books" of our own Board of Trade, and the Year-Books of the various departments of the United States Government effectively to this end, while the occasional use of other authorities for specific purposes is advisable.

Attention has so far been focussed upon maps, yet as the pupil develops it becomes advisable to take him a stage further than the map. He has already been led some distance in this direction since he has been required to turn all his statistical material into a percentage form; he has had to find out what percentage of the world's production or what percentage of the British supply of commodity X is due to country Y. He has been encouraged as a stage in his development to turn his percentage results into a diagram, and to mark upon his diagram simple fractions to illustrate the quantitative fact which he has determined. For example, he has found that Germany sends us 63 per cent. of our sugar supply, and that the sector of 225 degrees which this makes on a circular diagram looks like $\frac{2}{3}$, and he concludes that Germany is the source of $\frac{2}{3}$ of the supply of sugar to the United Kingdom. After some practice in the visualised form of his results, he is prepared to state his result fractionally without the help of the diagram. The diagrams are then dispensed with, which saves the time absorbed in their construction.

But he meets cases in which he wishes to record facts regarding two or three countries in reference to one commodity: at his present stage this means a sentence for each country, which is somewhat cumbrous. He therefore is introduced to a piece of "shorthand" description, with which he may have become familiar elsewhere in school. He begins to establish his facts as formulæ.

He makes formulæ, at first, of a simple kind: *e.g.* $Us_3R_1$, to denote that the United States produces $\frac{3}{4}$ of the world's maize, or $Ge_2R_1$ to state the sources of our sugar supply.[1]

Later, the formulæ are more elaborate: *e.g.* $Us_3In_1R_1$, to show that the United States produces $\frac{3}{5}$ and India $\frac{1}{5}$ of the world's cotton (British supplies—$Us_3R_1$): or $In_1Ch_1R_1$, to show that the world production of tea is shared equally by China, India, and the rest of the

[1] Countries are always distinguished by a capital and a small letter; R always means the rest of the world, or the remainder of the contributing areas.

world (British supplies—$In_5Cy_3R_1$. Cy = Ceylon). Still more elaborate formulæ occur at a later stage: *e.g.* world tea production may take the form $In_2Ch_3Cy_1R_1$: and the amount of home produce in relation to imports may be developed by a series of formulæ which are valuable as forming a series of pictures: *e.g.* in the case of wheat, $H_1R_4$ indicates that the home supply is $\frac{1}{5}$ of the total consumption: the proportion of the exports is shown by $Us_1Be_1R_1$, where Be = British Empire; these two may be combined in the form $H_1(Us_1Be_1R_1)_4$, which signifies that the United States and the British Empire each contribute $\frac{1}{5}$ of $\frac{4}{5}$, *i.e.* $\frac{4}{25}$ of the consumption of wheat in the United Kingdom. The case of wool will illustrate this point further: $H_1R_5$ shows that home produce is $\frac{1}{5}$ of the imports, Australia supplies $\frac{2}{5}$ of the imports—$Au_2Nz_1R_2$: the combined formula is $H_1(Au_2Nz_1R_2)_5$, from which it may be gathered that Australia supplies $\frac{2}{5}$ of $\frac{2}{5}$, *i.e.* $\frac{1}{3}$, of the consumption, and New Zealand supplies half of this, *i.e.* $\frac{1}{6}$.

Formulæ of this kind have one inestimable advantage, their compactness, and as they are determined in ever-increasing number it will be possible to place all the formulæ relating to a given commodity together in such a way as to have a conspectus of the most important features of the geography of that commodity.

The majority of these formulæ can be shown to represent a constant value within the degree of accuracy to which statistical data are accurate, *i.e.* at most 5 per cent.; yet some of them are only accurate for the present period. Coal production, as well as that of other minerals, is liable, by the accidental discovery or sudden exploitation of mines, to be rapidly changed; the production and export of wheat, as has been shown, may vary very considerably. Such a state of things does not preclude the use of quantitative methods, but rather calls for their fuller use; for inquiry into the causes of the violent fluctuations frequently lays bare some geographical truth, and adds to the clearness with which the whole subject is made manifest.

An exercise of great importance occurs in the establishment of a quantitative expression of the degree in which the British Empire as a whole competes with the United States as a producer and consumer. It serves as an excellent form of revision of the many exercises which have preceded it, and provided the list of formulæ is available, it will not require the expenditure of much time. Such an exercise leads to others of interest, not the least valuable of which would be an attempt to assess the comparative importance of the results which have been so far obtained from the attempts to grow cotton within the Empire. Such work will make clear in a short time that there is not a great likelihood that the cotton plantations of the Empire will produce within the next decade a serious alteration in the proportion of the world's cotton which is grown in the United States.

From the consideration of the world as a whole the pupil passes to the discussion of the separate countries, and here also quantitative facts are useful. Much of the work done in this connection is for various reasons intended merely as a *sample* of the kind of results which are to be found precisely for one country and inferred by analogy to be true

for other countries. For example, details are available concerning the ports of the United States, and from these it is possible to check the broad generalisation that of two ports A and B, if A is nearer to a country than B, A will in all probability take the bulk of the trade. The data for the United States show that this generalisation is invalid, in that New York bulks so largely in the trade of the country that she beats her competitors in practically every market, irrespective of distance. When it is found from other tables that most of the great trading nations have one or two similar great ports, it becomes a fair inference to assume that the great port will usually beat a second port in the same country in the trade with a neighbouring country which is nearer to the second, though smaller, port. Such an assumption may not be valid, although no evidence is available either way; yet the geographical exercise which is embodied in making the analogy between the great port and New York, in thinking whether the factors which account for the greatness of New York operate also in the second case, is of great value.

Similarly, the data for India provide facts regarding the interstate trade in that country. A study of the quantitative facts yields certain results, and a useful exercise is obtained in the consideration of the analogy between the states of India and the states which make up the United States or the definite regions which make up the British Isles. Are the same factors likely to produce analogous results? This is one aspect of the home trade of a country, which of necessity must form the daily work of a large proportion of the population. The French statistics give data for the coasting trade of France, and lead to similar geographical reasoning.

Entrepôt trade in London and Singapore, canal traffic at Antwerp and Rotterdam, traffic between an inland state like the Transvaal and the states which lie between it and the sea, to mention a few matters only, are samples of bases for similar reasoning.

When the countries have been studied in detail, a useful revision exercise may take the form of a comparison between the shore-lands of the three great ocean basins, the Atlantic with its outliers, the Indian, and the Pacific. Under the heads of people, production, consumption, and exchange it will be possible to group the quantitative facts, frequently as formulæ, in so definite a manner as to revivify knowledge which has been partly forgotten.

Finally, we attempt to study the details of the geography of our own country by the intensive study of small portions of it.

We learn about the whole from the analogy which we assume to exist between the small area and the greater whole. For example, the boys study the area comprised in a single sheet of the Ordnance Survey map, they find intensively the facts, quantitative or other, concerning this little district. They argue that similar conclusions are true for the larger district in the immediate neighbourhood, and they check the analogy by a consideration of the broad facts of similarity which exist between the small portion and the larger district. To do this they attempt to find whether the small area is a fair sample of the county of

which it forms a part; they study the relief, the climate, and infer that there is a close resemblance; they introduce a further check, they obtain quantitative facts regarding both areas, and on the basis of the ratio which exists between the area of the two in acres they find out whether an almost equal ratio exists in other matters which are capable of measurement, *e.g.* the Padstow District (Ordnance Survey, large sheet series, 139) is $\frac{1}{4}$ of the area of Cornwall, yet the wheat production is $\frac{1}{5}$ of the production of the county, etc. Taking all the facts into consideration, they conclude that there is a close resemblance between the district and the county; they can account for the matters in which the resemblance is not very close. They argue, therefore, that the facts they know about the small district are typical facts regarding Cornwall, and they consider further that to the extent to which Devon resembles Cornwall the detailed facts that they know are typical of the whole Cornish Peninsula.

Intensive study of about half a dozen such areas, which have been selected so as to present wide contrasts, and which include the home area as one example, must add greatly to the pupils' outlook over their own land. Such work rests essentially upon a quantitative basis, and introduces the pupils to methods of investigation and argument which they can employ in later life.

In conclusion, it may be added that experience shows that the frequent use of quantities, the regular appeal to statistical information, does not cause the pupils to have a distaste for geography. Provided the quantitative method is introduced gradually, and keeps pace with the growing mathematical ability of the pupils, they neither like nor dislike its use; they regard it as the normal way of studying the subject. In one respect they appreciate its results very clearly, they are more certain of the data upon which they base their reasoning, and therefore their conclusions gain in definiteness and accuracy.

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## GEOGRAPHY IN SCOTTISH SCHOOLS.[1]

By T. S. Muir.

The subject of this paper is the position of geography as part of the curriculum in Scottish schools. That involves some reference to the value of geography from a scholastic point of view, to past and existing methods of teaching it, and a look into the future, or what I conceive and desire to be the future, of geography in a true scheme of education. The first and last of those—the value and the future of geography in schools—are so closely connected in principle and of so general a character that I shall reserve them for discussion until I have disposed of the more particular and practical subject of the past and present methods of teaching.

[1] A paper read before Section E (Geography) at the Dundee Meeting of the British Association.

In the vast majority of schools in Scotland not only the choice of subjects and the amount of time devoted to each, but even the scope and the treatment, are settled by external considerations. Those external considerations are mainly examinations which are either on a competitive or a qualifying basis. The best type of the first is any University bursary or scholarship examination; of the second, is the entrance examination to a University. In some cases the method of teaching is prescribed, or at least indicated, in manuals or in special official pamphlets which teachers may purchase. The various Training Colleges also pay great attention to method. Text-books are naturally modelled on lines suggested by the requirements of the various examining bodies. Consequently all reforms must come from above, which is the last place whence one generally looks for them. Of course, a teacher who has not yet degenerated into a machine cannot hinder his or her individuality from manifesting itself, and thus the most barren of codes may be made to blossom by the exercise of humour and imagination.

So far as I am aware no schools in Scotland are independent of outside supervision in some form or another. Nor should I ever advocate taking what would be the retrograde step of permitting complete freedom. Obviously the great advantage of the intervention of an unbiassed, authoritative body is the fixing of a certain minimum of efficiency below which no school may drop with impunity. But outside interference in method of teaching is another matter. Doubtless it is done with the best of intentions. For example, the Scottish Education Department has recently issued a "Memorandum on the Teaching of Geography in Primary Schools." In the prefatory note it is said in so many words that, "as a rule, no attempt will be made to formulate a definite scheme of instruction." Waiving the phrase "as a rule," although it might be made to cover a large extent of ground, I may point out that anything which a Government department issues cannot fail to carry authority with those who in a sense are in its power; and secondly, that in the memorandum several opinions are expressed and recommendations given which cannot meet with agreement among teachers of the subject.

To return from this brief but, I think, necessary digression, the old method of teaching geography is slowly but surely dying out in Scotland, and the memorandum just referred to will undoubtedly hasten the process. I need not dilate upon the old school of geography teaching or rather instruction. You must all be familiar with it, and will remember most vividly your sufferings. There was the text-book packed from cover to cover with the hardest and driest of facts, with not the slightest attempt at correlation or the suggestion of reasons; lists of capes, bays, rivers, towns, and populations to be got by heart, and so on and so forth. Not a gleam of light, a touch of colour, nothing human or humane. Even map-drawing was made purely a matter of memory. This soulless drudgery was enforced everywhere until about half a dozen years ago. I am continually meeting people who retain such painful recollections of the geography class in their old schools that they hate the very name of it to this day. Those who, like myself, preserve more agreeable feelings owe it to their having had some

interest of their own. Mine was books of travel and the collection of foreign stamps. Thus I associated the Zambesi with Livingstone, and Nicaragua with a mighty lake. It may well be asked why are people so bitter against geography and not against Latin, for example, where the drudgery was just as severe? The answer is, I take it, that in after years one recognises the value of Latin as a mental training, but sees no possible shadow of benefit to be gained by learning lists of capes and bays. There is also a real grievance in the fact that geography can be made interesting.

In the cities and large centres of population the new method may be said to be established, but the old still lingers in the country districts. For this one cannot blame the teachers. Doubtless the "old Adam" is strong in, shall I say, the more conservative of the profession, but among the younger members enthusiasm for the new is marked. The great impediment lies with the School Boards. These bodies, always cautious in some respects with public money, are loath to spend even the small amount required for a modest modern equipment. When giving a course of lectures to teachers last winter not so very far from Edinburgh, I was most careful in making recommendations to confine myself to suggesting good text-books and good maps. I was assured, however, that even these were difficult to acquire; and you will agree that the lot of a teacher, confined to old-fashioned, dreary books and ancient political maps, is not to be envied. The primary school teacher who has to cover a wide range of subjects has no time to make his own equipment, and besides he has not the training, and cannot be expected to have the training, which would enable him to construct his own physical maps. He is in the hopeless position, therefore, of being called upon to produce bricks without straw.

So much for the primary school, let us now turn to the intermediate and secondary school. In the intermediate school the pupil is carried on to his sixteenth year, while the secondary school completes his scholastic education, and sends him out at the age of seventeen or eighteen to face the world. The close of the former period is officially recognised by the examination for the intermediate certificate, and the latter by that for the leaving certificate. It is unnecessary here to enter into detail as to the intricacies of our Scottish educational system, and to enlarge upon the complications and overlappings of supplementary, higher grade, junior student, and secondary schools. It is probably sufficient to say that a secondary school may and usually does provide a complete education for pupils between the ages of five and eighteen. On finishing the course at a secondary school a pupil is supposed to be ready to enter the University, some branches of the Civil Service, or other similar career.

The teaching of geography to pupils above the age of twelve—that is, after the completion of the elementary stage—is, as I have already indicated, governed by the requirements, first of the intermediate, then of the leaving certificate. In the intermediate examination separate papers are provided in Geography and History. Both, however, are combined with English—that is to say, a pass in English means a pass in English,

History, and Geography—and each of the latter two is allowed a maximum of fifty marks as compared with one hundred marks for English, Latin, and other papers. English, History, and Geography are compulsory for all candidates. The Education Department does not actually prescribe a time allowance for the teaching of geography, but a very general practice is to allot two periods of forty-five minutes each per week.

The examination for the intermediate certificate is in two parts—written and oral. The oral examination is simply for the purpose of reconsidering doubtful pupils. It is conducted by a Government inspector, who has before him the marks gained in the written examination, and a numerical estimate by the teacher of each pupil's ability. The written examination has a time allowance of one hour and a half, and it consists of three sections. In 1912 Section A contained three questions, all of which had to be attempted. Three outline maps were provided —the World, Europe, and the British Isles—and candidates were asked to insert names in their proper places, to show by a dot the position of certain towns, and to write the name of the town close to the dot: in the British Isles map to shade the hilly regions, put in cross-channel routes, and mark a few towns. I have been unable to discover any connection whatever between any of the facts required to be shown, and still less between this section and either of those following. The maximum of marks attainable was thirty.

Sections B and C had each four questions, one of which only was to be attempted in each case. Ten marks were allowed for each, thus bringing the total marks for the paper to fifty. I have no very strong objections to make on this portion, except that "Tell what you know of the life and work of any one of the following:—Marco Polo, Columbus, Captain Cook, Stanley, Nansen" is a historical and not a geographical question. This one, however, is quite admirable: "Describe the country that can be seen on a fine day from any good view-point near your school. Illustrate your answer by a sketch-map. Show the directions."

In the post-intermediate stage conditions are completely changed. English is the only compulsory subject. Geography and History are now separated from English, are optional, and are said to be on an equality with all the other subjects. The written examination lasts for two hours and a half, and has a maximum of one hundred marks allotted to it, while I imagine that the oral examination as before is for the benefit or otherwise of doubtful candidates. The Education Department states that as much will be expected of candidates in Geography as in other subjects, leaving it to be inferred that the time allowed for teaching should at least stand comparison with, say, French or English, but announces its willingness to consider time-tables submitted to it. One would expect that one period a day, or three and three-quarter hours per week, would be a reasonable amount. My information on this point is not extensive, being confined to schools in Edinburgh and Glasgow, but the largest allowance of time I have heard of is three periods, or two and a quarter hours a week. I know of cases where

pupils who had had only one and a half hours of geography a week were presented for the examination, and the total number of candidates for Scotland was about four hundred. It would be interesting to know (1) the maximum possible number of candidates in Scotland; (2) the average amount of time allotted to geography in schools from which candidates were presented; (3) the proportion of candidates which passed; (4) the number of schools where no provision is made for the teaching of geography in the post-intermediate stage. It will be part of the duty of the newly formed Association of Teachers of Geography in Scotland to throw light upon these points.

For the paper set in 1912 I have little but favourable criticism. Most of the questions are fair, the choice is wide, and the range considerable. In many cases the candidate is required to think and to reason as well as to remember. I have only to remark, first, that the paper is too long: secondly, that two of the questions—and those are compulsory—are extremely objectionable. The whole of Section A must be attempted. A portion of an O.S. map is given on a separate sheet. The scale is two miles to an inch, and the contour lines are coloured. The candidate must first draw a section along a given line, apparently purely arbitrary, or, in other words, from one spot of no importance to another nowhere in particular: secondly, he is to determine the number of square miles in a specified roughly triangular area. Now section-drawing, unless for some specific purpose, such as to illustrate the gradient of a river-valley, is an abomination. After doing two sections a pupil can draw a thousand. It is purely mechanical, and requires merely a little care and a great deal of time. Then in determining areas, whatever method is employed and however painstaking the candidate, the answer will not even be approximately correct. Besides, what is the sense of asking a pupil to use a bad method in order not to find out something that is accurately known and recorded in a blue-book? The study of O.S. maps may be made a very valuable exercise and provide very valuable training, as is indeed shown to some extent by the other questions in the section, but the two I have mentioned are in my opinion ingenious pieces of drudgery and nothing more. One is inclined to think that they have been foisted upon teachers by people who are not more than half converted to modern methods.

Before coming to the concluding portion of my paper—the value and the future of geography in education—I must refer again to the effects of the action of the Department in making geography an optional subject in the post-intermediate stage. I am not aware of any cases where the time allotted to geography teaching has been increased; I know of several where it has been diminished, and of some where it has absolutely vanished. But for the fact that geography is required in the University bursary and in Civil Service examinations, I am sure that the number of schools in which geography forms no part of the post-intermediate curriculum would be greater than it is. Now what is the basis on which the Department founds its policy? It is that there are two classes of subjects, or rather two distinct stages in the school life of

any subject—one mainly informative, the other mainly cultural. At the end of the intermediate stage the pupil is held to have acquired a sufficient store of information, or at least it is presumed that he will devote himself during the remainder of his course to specialisation. There is one exception. English, divorced from Geography and History, is still compulsory. The pupil has several courses open to him. He may drop most of his previous subjects save English, and take up Greek, Latin, or German: Mathematics, Drawing, or Science: but he cannot take English, History, and Geography. Why is English compulsory? At the end of the intermediate stage a pupil may be considered to have mastered spelling, to be able to express his thoughts in decent English, and to have read sufficiently to make him wish and to guide him to read more. To my mind English in the post-intermediate stage is more of a "culture" subject than almost any of the others, with the possible exception of drawing. The teaching is purely literary, and, while of the utmost value to a certain type of mind, it is not suited to all types.

Now geography remains largely an informative subject to the very end. As the pupil becomes older we continue to widen his horizon, to increase his sum of knowledge. For facts are the basis of geography. We can do nothing without them. The only sound method of teaching is to begin with the pupil's observation of his own surroundings, and to introduce gradually and appropriately the results of the observations of others. I would advocate the allowance of considerable latitude to teachers. While it is advisable to prescribe a certain minimum to be overtaken in a particular year, I should leave time for deviating into pleasant by-ways. A few days of frost or snow might suggest a Polar winter. A summer thunderstorm might lead to a talk on Assam or other region of heavy rainfall. A teacher who happens to be a mountaineer can lend additional interest to a lesson on Switzerland. It is unnecessary to multiply examples, and I do not wish you to think that the few minutes occasionally devoted to such casual teaching are of paramount importance, but they are far from being wasted.

I have here been touching in a vague way upon what makes geography, properly understood and taught, the most important and the most valuable of all the elements in scholastic education. It is a big claim to make, and in order completely to justify it I should have to explain my views on the ultimate aim of education. I should also have to set up all the other subjects in a school curriculum, and then knock them down again with the bowl of geography, but I have no intention of doing it. You would object to a lecture of an hour's length, and you are in any case, I presume, the converted. But let me mention one or two points.

Should a pupil learn to be accurate, painstaking, careful: should he cultivate his powers of observation, of recording facts, of reasoning from those facts: should he possess a store of information gathered in such a way that one fact or group of facts calls up another: in short, should he develop the faculty of association? All this is to be found in geography. And there is more, for there is the human, the personal element.

Geography deals not only with the world in its physical aspect, but with the influence upon man of his environment and of the reaction of man upon his environment.

Now, is it reasonable to suppose that a pupil of fifteen can have touched upon more than the elements of geography, especially when one takes into account the brief time devoted to it? More than that, there are many problems in geography which a pupil is not fitted to attack until after the age of fifteen. His mind is not sufficiently formed. Yet in many Scottish schools that is precisely the stage at which geography ceases, or practically ceases, to form part of the curriculum.

What remedy, then, do I propose? The Education Department has already been approached, and, on totally inadequate grounds, has refused to reconsider its decision. I respectfully submit, therefore, that pressure may be brought to bear upon the Department by way of the House of Commons. Permanent officials are proverbially, and in this case truly, difficult to move, but an active and zealous member of Parliament, or better still, several such members, might, not by faith but by votes, accomplish wonders. A teacher of geography, if participating too prominently in such an agitation, is apt to be suspected and possibly accused of interested motives. Even if he gets some credit for pure zeal he is not powerful enough to produce much effect, but a strong expression of opinion from a body which cannot be so suspected could not fail to evoke some response even from a Government department. Lectureships in Geography exist in the Universities of Edinburgh and Glasgow, and their establishment was hailed everywhere as a sign of most desirable progress. It cannot but happen in the near future, since the source is seriously endangered, either that the supply of students will be reduced to vanishing point, or that the quality of that supply will deteriorate.

Such considerations, however, are of minor importance compared with the main issue which I shall now put to you. It is quite possible for a man to be a useful and intelligent citizen without possessing a knowledge of French or German or Higher Mathematics, or even Greek or Latin, but I submit that without a sound and complete training in geography there will be something vitally lacking in his equipment. I ask you, therefore, to consider the advisability of declaring that geography ought to be a compulsory subject in the post-intermediate as well as in the intermediate stage in Scottish schools.

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## GEOGRAPHICAL NOTES.

### Europe.

**Morphology of the Central Apennines.**—In an article on this subject in the *Geographische Zeitschrift* for May 21, Mr. Robert Almagia points out that from a variety of causes much less is known of the

Apennines than of the Alps, and this is especially true of the central region, in regard to which the literature is scanty. In his article, which is accompanied by some good illustrations, he limits himself to a discussion of three topics, glaciation, karst phenomena, and weathering in the clay districts. In regard to the first, the most obvious indication of glaciation in the region is not the occurrence of moraines, but the abundance of cirques. Some of these are much weathered, but others display the typical form, the floor sometimes taking the form of a meadow. Morainic deposits do occur, but not in the typical mounds, and they are often mingled with other deposits. The Gran Sasso region, as the highest and most imposing of the whole Apennine range, is naturally the best glaciated, and here the mountains have the peaked and ridged shape characteristic of Alpine *Hochgebirge*; elsewhere the forms are mostly of the rounded *Mittelgebirge* type.

As would be expected from the wide prevalence of limestone, karst phenomena are singularly well-developed in the Central Apennines. Caves and blind valleys are frequent, but the most striking feature is the occurrence of extensive depressions, which present certain resemblances to the *polje* of the Balkan lands, though it is not certain that their origin is the same. Between the rivers Nera and Chienti especially a number of these depressions occur, *e.g.* the Piano di Collecroce, Piano di Colfiorito, etc. Many of these were lake basins in Pleistocene times, and some of them are still covered with water in winter. Another characteristic feature is the scarcity of water in the centre of the chain, and the appearance of copious springs at the margins of the calcareous massifs.

The great masses of limestone which form the central area are fringed towards the Adriatic Sea by a series of softer rocks, which form a girdle of varying width, sometimes interrupted. Among the sandstones and sands, etc., of these beds there occur also great beds of clay, which give rise to a characteristic topography. In places the clays also appear on the Tyrrhenian slope, notably in the valley of the Volturno and its great tributary the Calore. The clays weather with great rapidity, and in addition to the normal slow process of erosion, catastrophic changes are frequent. In Italy the term *frana* (*franare*, a fall of earth) is applied to all such sudden modifications of the surface. Such *frane* occur in the Adriatic Sub-Apennine zone in the basin of the Pescara, but they reach their maximum distribution in the valleys of the Sangro, Trigno, etc. Here, during the rainy season, in great stretches of the valleys, the whole of the banks of the streams become moving sheets of mud, while in summer these banks dry out and resemble the Bad Lands of Dakota. Periodic avalanches sweep down the slopes, often destroying whole villages. Elsewhere the surface is cut up by innumerable steep-sided ravines, separated from each other by sharp ridges, forming what are called "calanchi."

One consequence of the rapidity of erosion is that the valleys, which, especially on the Adriatic side, are of very recent formation, tend to take on mature forms early, that is, the valley floors become broad, the slopes gentle, and so on. Thus the contrast between the regions where

the soft rocks occur and the limestone regions is very marked. In the latter the largely deforested hillsides are white and rocky, the streams have few tributaries, are mostly fed by powerful springs which often rise on the valley floors, and run in deep, narrow, rocky gorges. In the former there is a great series of grey or yellow hills, whose unstable slopes are frequently unfitted for cultivation, and are cut up by many interlacing streams, the beds of which in summer are either quite dry, or carry only meandering trickles of water.

This contrast in topography brings with it a corresponding contrast as regards the distribution of man. In the limestone region habitations cluster round the springs, and the great karst basins are often thickly peopled. Thus round Fucino the density is 295 per square mile, and in the basin of Aquila it rises to 615 per square mile, though both regions lie at an elevation of about 2000 feet. On the other hand, the valleys of the Adriatic rivers are less populous. The part of the Sangro valley which lies on clay has a population of less than 230 per square mile, while the Trigno valley has less than 211. Further, the settlements here always rise high above the valley floor, being mostly placed on some outcrop of the limestone. The actual valley slopes, on account of their instability, are practically uninhabited. The contrast is also marked as regards means of communication. In the limestone region the routes run along the valley floors, in the clay region they mount high up the sides of the valleys, in the effort to find stable ground.

**Distribution of Population in the Eastern Alps.**—Professor Norbert Krebs, in the course of his preparation of a volume on the Eastern Alps, which is to appear next year, has made an investigation of the extent of the inhabited and uninhabited areas here, and contributes a summary of his results to the *Geographische Zeitschrift*, No. 8. He has obtained the assistance of some of his students in making planimetric measurements of the two areas, and gives the results in the form of a table. This table shows that in the greater part of the Central Alps and of the higher calcareous Alps, the uninhabited area exceeds three-quarters of the total. Only in isolated areas of the Flysch zone, and in the south-eastern Voralps, does the percentage of uninhabited land sink below one quarter. In the case of the higher percentages the causes of the paucity of population are the height of the land, the climate, and the nature of the rocks, while the history of the region and the particular form of husbandry carried on also exert their influence. In the Silvretta, Adamello and Zillertaler groups the percentage of uninhabited land rises to over 85, because the narrow, over-deepened, flat-bottomed valleys, excavated in very hard rock, are difficult to utilise. On the other hand, where the valleys are excavated in schistose rocks the population increases, to diminish again in the calcareous plateau of the Salzburger, Julian, and Austrian High Alps, on account of the scarcity of water, and the step-like formation of the rocks. The extensive screes of limestone districts are also an unfavourable feature, in that they diminish the area within which dwellings may be placed. They help to drive population from the Lechtaler Alps and

the Karwendel Mountains. The absence of a humus layer in the lower dolomitic regions also helps to diminish population, for it renders these useful only as forest lands, and they tend to become the hunting grounds of wealthy landowners. On the other hand, where schists occur, water and humus are alike abundant and population increases.

The upper limit of population is more or less parallel to the limit of cereal cultivation, and usually lies some 30-60 metres below it. Both limits vary greatly with exposure and other factors. Further, the limit of habitation is always higher in the centre of a mountain mass than near its margin. In detail the distribution of the population in the valleys varies with the nature of the rocks. In limestone districts habitations tend to be limited to the bottom of the valley, because the characteristic shoulder of the glaciated valley affords here an inadequate water supply. On the other hand, where schists predominate, this terrace is inhabited no less than the valley floor.

The author then goes on to give some detailed examples of the relation of the distribution of the population to the form of the land and to its geological structure. Of more general interest is the discussion of the effect of the particular type of agriculture practised upon the upper limit of population. In Italian Tyrol the preference of the peasants for the cereal maize brings down the upper boundary to the elevation at which this plant will thrive. Further, the Italian-speaking peasants show a marked preference for walled towns and villages, and these can only be built at relatively low levels. On the other hand, where, as in the Central Alps, pastoral industries prevail, the limit of habitation may rise high above the cereal limit, and show no relation to it.

The paper concludes with some discussion of political frontiers in relation to distribution of population.

## Polar.

**Expedition to Spitsbergen.**—An expedition consisting of Dr. W. S. Bruce and Dr. R. N. Rudmose Brown left Edinburgh for Spitsbergen late in July. The expedition, which was for prospecting and survey purposes, was despatched by a British company having large commercial interests in Spitsbergen. Tromsö was reached by Norwegian mail boats *viâ* Newcastle and Bergen and thence the voyage to Spitsbergen was continued in a small motor fishing-sloop. Heavy weather protracted the voyage from four days to a week. The expedition was encamped on the shores of Sassen Bay, where much prospecting and topographical survey was accomplished. Owing to the failure of a Norwegian steamer to reach the explorers, on account of heavy ice, it was necessary to retreat in a small boat and on foot to the American Coal Company's mine in Advent Bay. Sassen Bay was crossed and Dr. Bruce and Dr. Brown then walked through the heart of Spitsbergen by De Geer Valley and Advent Dale to Advent Bay. Much of this route had never before been traversed and was unexplored. From Advent Bay the return voyage to Tromsö was made in one of the American Coal Company's boats, and Edinburgh was reached on September 6.

## General.

**Distribution of Coral Reefs.**—Professor L. Joubin has recently published in the *Annales de l'Institut Océanographique*, under the auspices of the Prince of Monaco, a paper on the distribution of coral reefs, illustrated by an atlas containing five large maps. In the *Annales de Géographie* for July 15 he gives some account of this work, illustrating by one of the five plates of the atlas. In this article he points out that hitherto it has been very difficult to obtain exact information in regard to the exact distribution of reef-forming or madrepore corals, for the nautical charts of the various nations do not differentiate between these corals and other lime-secreting organisms, such as calcareous algae and the deep-water corals. Yet the madrepores are of geographical importance, because their occurrence presupposes the existence of two conditions—shallow water and warmth. They can only live in water which is well illuminated, and in consequence do not occur at greater depths than 40 metres, that is about 22 fathoms. Further, temperatures below 20·5° C. (69° F.) seem to be fatal. Now surface water permanently of this temperature only occurs within a band limited by the parallels of 30° N. and 30° S., and it is far from universal within these limits. In places, as *e.g.* off western South America and western Africa, cold surface currents limit the corals to a region close to the equator. Elsewhere, as off the Bermudas, warm currents permit them to extend their zone of distribution even beyond lat. 30 N. The existence of coral reefs therefore at any part of a coastline enables the geographer to draw conclusions as to the temperature of the surface water there.

In constructing his map, Professor Joubin has employed the equatorial zone of the Prince of Monaco's Bathymetrical map, omitting all indications of depths exceeding 100 metres. On the map so obtained he has plotted the distribution of the coral reefs, obtaining the facts from the collation of an enormous mass of material. The reefs are shown in red, a distinction being made between those permanently submerged and those which appear at the surface, at least at low tide. Where possible the reefs and banks have been indicated to scale; where the reef is too small for this to be done a dot is used to indicate its presence. The result, as shown in the specimen map issued by the *Annales de Géographie*, is exceedingly irregular, the reefs sometimes fringing a particular coastline uniformly over a great stretch, and elsewhere on the same coast being totally absent over large areas. The paper does not contain any discussion of the cause of the very irregular distribution, but the map will undoubtedly be of enormous use to any one undertaking such an investigation, and is a beautiful piece of work.

**Results of the "Michael Sars" Expedition.**—In the address entitled "The Deep Sea," delivered by Sir John Murray before the Society in November 1910 (cf. *Scottish Geographical Magazine*, xxvi. p. 617), the fact that Dr. Peach was engaged in examining the stones brought up by the deep-sea trawl was briefly alluded to

(p. 624). A summary report of the results of Dr. Peach's examination has appeared recently in the *Proceedings* of the Royal Society of Edinburgh, vol. xxxii. part iii., and contains some facts of great interest.

In addition to making a detailed examination of the rock fragments obtained by the *Michael Sars*, Dr. Peach has re-examined the material collected by H.M. ships *Triton* and *Knight Errant*, while dredging over the Wyville Thompson ridge and the Faroe Banks in 1882 and 1880, and the comparison has brought out some important facts. Of the *Michael Sars* collections the most important was that obtained from station 95, in lat. 50° 22′ N., long. 11° 44′ W., in a depth of 981 fathoms. This station is situated some 230 miles south-west from Mizen Head in Ireland, and here some 200 rock fragments were obtained, in addition to a large amount of furnace slag, and other material which had obviously fallen from ships. The rock fragments consisted of sedimentary, igneous and metamorphic rocks, the most striking feature in the collection being that the rocks represented are those that occur *in situ* in the west of Scotland and in northern and western Ireland. In addition to this positive character, the collection, despite the great diversity of rocks represented, showed the negative one of the absence of those rocks which do not occur in the regions named, though widespread in England.

Of the total number of fragments and pebbles, more than 53 per cent. were ice-moulded or glaciated, and the proportion of angular and rounded fragments to the glaciated ones is not much in excess of that found in boulder clay, and is much less than that occurring in Alpine moraines.

The fragments were found embedded in Globigerina ooze, made up for the most part of the shells of warm-water surface foraminifera. From the characters of the surface of the stones it is possible to make out to what extent they were buried in the ooze, for the exposed surfaces are covered with marine organisms, and with a slight coating of manganese oxide, absent from the buried surface. In this way it is possible to show that the stones were resting in apparently unstable positions, these positions indicating that they were probably dropped into a flocculent ooze, into which they at first sank. Later current action partially removed the covering of ooze, and exposed parts of their surface. Thus the first point of interest is that the stones demonstrate the existence of current action, even at this depth (nearly 1000 fathoms).

The second point of interest is the agent which brought them here. Some may have been brought by part of the polar pack since glacial times, or by floating seaweed, some perhaps by ice-pack or river ice during the later part of the glacial period, but the majority seem to have come from the bottom moraine of the ice-sheet at the period of maximum glaciation. It is believed that ice from the west of Scotland forced its way to the north of Ireland, and there united with Irish ice and split up into two streams. One of these filled the Irish Sea, stretching down at least as far as Cork. The other branch passed westwards into the Atlantic, and reached deep water at the edge of the continental shelf. But when floating ice from this sheet was reaching the region of the station,

surface currents of warm water from the west must at the same time have been bringing foraminifera, whose shells formed the ooze, and the depth conditions must have been much as they are now, *i.e.*, the continental shelf must have been already submerged.

The rock specimens collected by the *Knight Errant* and the *Triton* consist of the kinds of rocks represented in north Scotland and Scandinavia, and are mostly glaciated. The evidence goes to show that they were lying on hard ground, and were probably once surrounded by glacial clay which has been washed away by current action. They therefore probably formed part of the ground moraine of the great ice-sheet, due to a combination of Scandinavian and Scottish ice, which streamed out over the present Wyville Thompson ridge. There is reason to believe that the continuation of this ridge, which now connects Faroe and Iceland with Greenland, stood then much higher than at present, and the probabilities are that the European ice-sheet united with that from Greenland and Iceland, and thus formed a barrier shutting out the warm water of the Atlantic drift from the polar basin. The whole of the Gulf Stream water would then have to make its way southwards, instead of passing up the east of Greenland, and this would help to explain the distribution of the material dredged by the *Michael Sars* from the Atlantic.

**The Location of Icebergs.**—Professor Howard T. Barnes delivered some months ago a lecture before the Royal Institution on this subject, and an abstract of his address appears in *Nature* for June 20. He points out that although observations on the temperature of sea water are taken as part of the daily routine on board steamships, yet the observations are made in such a fashion as to be almost useless. In view of the great importance of discovering methods by which the presence of icebergs in the immediate neighbourhood of a ship may be indicated, he has devised a very delicate instrument, called the micro-thermometer, working on the same principle as the electrical resistance thermometer, which registers very small temperature variations. By the use of this instrument it is possible to show that when a ship approaches an iceberg there is first a rise of temperature and then a sudden fall. The meaning of this "iceberg effect" is easily explained on the basis of Pettersson's experiments. Dr. Otto Pettersson has shown that ice melting in sea water gives rise to three currents. As melting occurs the surrounding sea water is cooled, and sinks by convection. It is replaced by warmer sea water, which flows towards the ice, giving rise to a horizontal current. The fresh water produced by the melting does not mix with the surrounding salt water, but lies upon the surface and moves with the melting ice. The temperature changes can be explained as follows: The rise of temperature is due to the presence on the surface of a layer of fresh water which has been warmed by the sun. As the berg is more nearly approached the water just produced by melting is reached, and this, which has not had time to be warmed, causes the thermometer to fall. These two changes of temperature are diagnostic of the presence of ice.

Another interesting point which has arisen in the course of the investigations is that remarkable temperature changes occur on nearing land, and it seems probable that the micro-thermometer can be used as a means of locating shoals or land.

**The late Prof. F. A. Forel.**—Prof. Forel, of the University of Lausanne, known by his long series of researches on Lake Geneva, and his great monograph on the same subject, died on August 7 at the age of seventy-one years. Prof. Forel, according to the author of the obituary notice in *Nature*, "may fairly be considered the founder and chief exponent of the scientific study of lakes," and those who were present at the Ninth International Geographical Congress at Geneva, in 1908, will remember with gratitude the combination of learning and eloquence which distinguished the two short addresses which he gave upon his beloved lake during the course of the official excursion to it. He made the study of Lake Geneva in all its aspects practically his life-work, and the author of the notice alluded to quotes from his writings so charming an expression of this devotion, that we cannot forbear a citation. In 1875, when Forel was investigating the seiches of the lake, he sat for many hours motionless beside it, watching one of his instruments, and was there accosted by a schoolmaster, who found such conduct unintelligible, even after explanation, and met Forel's exposition of the subject by the question, "Zu was nützt das?" (What is the use of it?) Forel writes: "Il est vrai que j'ai consacré à ces recherches bien des heures, bien des journées, bien des années de ma vie. Mais j'avoue que, dans mon for intérieur je ne me suis jamais senti humilié d'avoir dépensé autant de cette denrée précieuse entre toutes, le temps qui s'écoule et ne revient pas, à un thème sans utilité immédiate et pratique. . . . Quand nous aurons trouvé une confirmation de quelques données de la théorie pure par l'observation directe d'oscillations qui mettent en mouvement de balancement aussi bien la masse énorme des 89 milliards de mètres du Léman, que les quelques litres d'eau de nos auges d'expérimentation, n'aurons-nous pas là une vérification précieuse! . . . Mon cher inconnu de Romanshorn, à ta question: 'Wozu nützt es?' je réponds: 'Es nützt doch etwas.'" "It has always some use": this is the halting reply which is all the man of science can make to the insistent questioning of the crudely practical man. But Forel succeeds here in voicing the emotion which makes him persevere in his self-imposed task, despite the scepticism of the inquirer, and he himself persevered till the end.

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## EDUCATIONAL.

We have received from Messrs. Shearer & Son, of Stirling, an interesting chart, showing the mountains visible from Ben Cleuch, which has always been noted for the admirable view it commands, despite the moderate elevation above sea-level (2363 feet). The chart, which costs

sixpence, includes a short account of the means of access to Ben Cleuch and the easiest routes up it. The mountain might very well form the object of a school excursion, and Mr. Shearer's chart would prove most useful in identifying the main objects of interest.

In the same connection we should like to draw attention to an article by M. Ph. Glangeaud in *La Géographie* for April 15 on view indicators and means of increasing their value. As is well known, such orientation tables are frequently to be met with in France, where the Touring Club and other bodies have set them up on most of the famous view-points of that country. But M. Glangeaud points out that, excellent as these are, they date from the period of the "old" geography, when the learning of names and figures was regarded as a good in itself. From the modern point of view they err both in often giving too many facts, and especially in presenting these facts without any consideration of their relations. Though the ordinary tourist will begin the study of an elaborate indicator with zeal, he is apt to become bored before he has made the round, and the ordinary memory cannot retain a tithe of the names and heights given. M. Glangeaud therefore suggests that a brief interpretation of the landscape should be added to the conventional "table d'orientation." This idea has been favourably received by the Touring Club, and the author was requested to compose a brief explanation to accompany an indicator recently set up by them on the summit of the Banne d'Ordenche in Auvergne. From this hill nearly all the old volcanoes of the Auvergne are visible, and M. Glangeaud's description indicates briefly the original height and shape of the various hills visible, and their characters at the period of volcanic activity. He has added a reconstruction of the old volcano of the Banne d'Ordenche, superimposing it in outline upon the existing landscape. The explanation has aroused a great deal of interest among the tourists who visit the hill, and there is a prospect that the plan may be carried out elsewhere. Is there no public-spirited club or society which could initiate a similar scheme here? Not only does Scotland contain many view-points of surpassing interest from the geographical standpoint—the view from Ben Cleuch, for instance, includes parts of the three great natural regions of Scotland—but also the country has always been the home of geologists and physical geographers, and we have thus not only the intrinsic interest of the scenery, but the fact that many important scientific generalisations were first established upon an investigation of its characters to add significance to the story.

We have received from Messrs. Black two more instalments of their geographical pictures, the two packets sent dealing with the sculpture of the earth's crust, and treating of weathering and the work of ground water. Some of the views included in the packets are very striking, and the pictures should be of great value to teachers. The pictures are accompanied as before by Notes, which in this case give a brief general account of weathering, and also describe the pictures in detail.

# NEW BOOKS.

## EUROPE.

*Off Beaten Tracks in Brittany.* By Emil Davies. London: Stephen Swift and Co., 1912. *Price 7s. 6d.*

Mr. Davies, as one would conclude from the title of this book, has avoided the common and the commonplace, and has chosen those byeways of Breton travel which the ordinary tourist seldom or never treads. To the literary vagabond genus, at least of the orthodox type, Mr. Davies, and his friend who made the journey with him could scarcely be said to belong—there is no attempt to glorify the tour into a kind of epic poem. Yet the travellers kept their eyes and their ears wonderfully alert, and Mr. Davies who has the gift of humour and a pretty wit, sets forth their experiences in a most entertaining fashion; but if the occasion demands it he can be serious, moralise or philosophise in a way that is never tiresome.

Though the two companions started on a walking tour, that did not hinder them from travelling by train or by boat as the spirit directed: and though they determined, in the imperial manner of a certain Czar, to march straight from Brest to St. Malo, the reader will not go far ere he find this cast-iron rule was extremely flexible, and broken sometimes by the travellers' own fancy and sometimes by the simple fact of their losing their way. Their experiences were of all degrees, from the rapturous to the unbearable, as witness that through which they passed at 5.25 on a certain Sunday morning in Loudéac. Hotels and inns they visited with varying luck; and the important towns of the guidebook they not seldom found to be wretched villages, where to procure the elementary necessity of food was difficult. But whatever befell them is well worth the relating, and we are obliged to Mr. Davies for having given us this account of, as he terms it, Brittany *en déshabillé*.

*Tripoli and Young Italy.* By Charles Lapworth, in Collaboration with Miss Helen Zimmern. London: Stephen Swift and Co., Ltd., 1912. *Price* 10*s.* 6*d. net.*

This book is an apology for the war in Tripoli, written from the Italian point of view, and the case against Turkey and the political necessity for Italy are expounded in a spirit of partisanship which, it must be admitted, somewhat detracts from their value as impartial statements. The author is unsparing in his denunciation of the attitude adopted by a part of the British press and public towards the Italian adventure in Tripoli, and he declares that newspapers and politics in England are run by Chadbands and Stigginses. It is difficult to take Mr. Lapworth altogether seriously in his tirades; but we suppose allowance must be made for the natural irritation produced in Italy by the outcry from this country against the "atrocities" which marked the earlier stages of the war; and, for the rest, it is fair to say that Mr. Lapworth has much to tell which is of real value concerning the marvellous progress made by Young Italy, both economically and politically.

No doubt the Italian desire for a footing on the North African coast is partly the result of national sentiment aroused by the remains of Roman occupation which are so plentifully scattered along the shores of Tripoli, or Libya as the Italians prefer to call it. The opposition encountered from the Arabs, who were expected to welcome their deliverance from Turkish misrule, has been a shock to

the invaders, and Mr. Lapworth attributes this opposition to religious fanaticism stirred up by the Turks among the native tribes. His view is that when this opposition is overcome one of the finest colonies in the world will be built up, and that the commercial potentialities of Tripoli are much greater than is commonly supposed.

Mr. Lapworth acknowledges his indebtedness to the able collaboration of Miss Zimmern, and his preface states that some of the highest authorities in Italy have assisted the writers in putting their case before the English reading public. On the whole, *Tripoli and Young Italy* is a book to be read at the present juncture.

*The Italians of To-day.* By Richard Bagot. London: Mills and Boon, 1912. *Price* 2*s.* 6*d. net.*

Mr. Bagot, who has passed the greater part of his life amongst Italians in their own country, records it as his belief that the English, in their enthusiasm for an Italy of the past, "have altogether forgotten to study the Italy of the present day, with the result that, as a nation, we are profoundly ignorant both of modern Italian life, and of the character, temperament, aims and aspirations of the modern Italians." In the words we have quoted will be found the key-note of this little book. Mr. Bagot thinks that this ignorance has had a very deplorable effect on Anglo-Italian relations, and he applies himself to the task of enlightening his countrymen. Chapters are severally devoted to the Italian peasant, the workman, trades and professions, government and aristocracy, the army, and church and state; and, although British ignorance of matters Italian is perhaps not quite so profound as Mr. Bagot imagines, he deserves credit for having contrived to compress a great deal of information into small compass. The Italian workman is compared with the British, not to the advantage of the latter, but the author is inclined to depreciate most things British in his zeal for the land of his adoption. Under the heading of Church and State we find some interesting notes on the attitude of the present-day Italian towards his national church, and the author's views tend to show that the spirit of anti-clericalism is not nearly so strongly manifested now as it was twenty, or even ten or a dozen years ago. The improved relations existing between the Government and the Vatican under Pope Pius x. have no doubt a good deal to do with this: but other causes, too numerous for reference here, are set out by Mr. Bagot, and are, we think, worthy of attention. Readers who are interested in the question of universal military training will find food for reflection in the section which treats of the Italian soldier. The latter portion of the book is taken up with an apology for the invasion of Tripoli, and the chapter headed "Anti-Italian Calumnies" is a reprint of Mr. Bagot's article which appeared recently in the *National Review*. Mr. Bagot is well known as the writer of *My Italian Year*, and, in spite of the strong pro-Italian bias evident in this, his latest book, we can recommend it to all who are interested in present-day Italy.

## AFRICA.

*Dans Notre Empire Noir.* Par M. Boudet-Saint. Paris: Librairie Plon, Plon-Nourrit et Cie, 1912. *Prix* 3 *fr.* 50.

Only a short time ago (p. 491) we noticed at some length a work by M. Boudet-Saint, *L'Afrique Équatoriale Française*, and now we have another volume relating to the same subject, and based on the experiences of the same tour. Possibly the difference between the two works may be indicated by the fact that the former was prefaced by a grave introduction from the pen of M. Saint-Germain, who in the French Senate corresponds to our Colonial Secretary, and sets

forth the object of the book as "de voir, observer, étudier, analyser, et, de ce voyage, exposer tout ce qui, à un titre quelconque, était à même de faire connaître à nos compatriotes la valeur de notre grande colonie, son état actuel, ses éléments d'avenir, et les résultats acquis là-bas à notre pays par une sélection de ses plus vaillants citoyens." The present volume, however, is prefaced by an introduction from M. Abel Ballif, Président du Touring-Club de France, in which he says, "Ici, c'est un objectif tout différent que s'est proposé notre ami; dans ce style alerte et vivant, avec cet éclectisme, qui le caractérisent et que connaissent bien ses lecteurs, il a consigné au jour le jour, au fur et à mesure qu'elles se présentaient à son esprit, ses notes de voyage, ses remarques, sans négliger parfois maints accidents, menus en apparence, mais dont il sait toujours dégager, avec un à-propos, une bonne humeur bien française, l'enseignement ou la philosophie." To be strictly honest, we decidedly prefer the previous volume to the one now before us. More carefully and thoughtfully written, it contains practically everything that is in the later volume, and we must frankly own that the latter seems quite superfluous.

*In South Central Africa.* By J. M. Mowbray, F.R.G.S. London: Constable and Co., Ltd., 1912. *Price* 10*s.* 6*d. net.*

Mr. Mowbray spent six years as a mining engineer in South Central Africa, and in this volume he puts on record his impressions of what he saw there. His business took him into several out-of-the-way places, and he has some amusing and instructive tales to tell of the people with whom he came in contact. He met with no very exciting adventures or incidents in the course of his sojourn in Africa, but his simple and unpretentious account of where he went and what he saw is attractive and pleasant. His work is embellished by a number of good photographs, and is furnished with a useful map.

## AMERICA.

*Guiana: British, Dutch, and French.* By James Rodway, F.L.S. London: T. Fisher Unwin, 1912. *Price* 10*s.* 6*d. net.*

The publishers of the *South American Series* are to be congratulated on their selection of Mr. Rodway for the work of writing an account of Guiana. In the first place he has had very exceptional local experience, having lived in the colony something like forty years, and much of the work was already familiar to him, as in 1894 he had published an excellent history of British Guiana, in which, of course, he had incidentally to include a good deal of matter pertinent to what is now Dutch and French Guiana. It will be remembered that it was in the next year, *i.e.* in 1895, that President Cleveland very nearly succeeded in bringing about war between Great Britain and the United States by his peremptory insistence on our referring a disputed boundary to arbitration. The short period since Mr. Rodway published his book has been uneventful in startling historical events, but the progress of the colony has on the whole been steady and satisfactory, and of this Mr. Rodway is an excellent witness. Take, for example, the crucial question of what was to be done to supply the labour absolutely necessary if the colony was to be developed at all, since neither the emancipated slaves nor the indigenous population, either in numbers or in disposition, could be relied on for such a task. Writing of this, just eighteen years ago, Mr. Rodway said, "It is hard to say what should be done to develop the unoccupied lands of the colony (about 99 per cent. of the whole). As to the people most fitted to develop these regions, little can be said. At present there is no tropical race

sufficiently advanced to do so." This paramount difficulty has, however, been successfully surmounted by the immigration of East Indian coolies. Of these there are now in British Guiana over 126,000, of whom more than one-half have been born in the country. It is interesting to note that of this class of immigrant Mr. Rodway had said, "The Hindoo coolie is a failure as a colonist, although very useful under European control." Now he tells us, "The East Indian will certainly be the man in the future of Guiana if the immigration system is continued. Though not so strong as the negro, he is more reliable, and without him there would be no Demarara or Guiana sugar. He enjoys better health in the tropics than other races. . . . The East Indian is exceedingly interesting in every respect. His love for animals is hardly exceeded by that for his wife and children. A cow-minder is almost universally a coolie, and we may see him carrying a young goat in his arms as a shepherd does his lamb. Unlike the black man he takes his wife and family wherever he goes," and in one passage Mr. Rodway roundly declares that the East Indians "are fast becoming the backbone of the country." Writing in 1894 Mr. Rodway remarked that "Railways to Berbice on the West Coast of Demarara and in Essequibo have been advocated for the last fifty years, but every one looked to the Government to carry them out, with the result that nothing has been done." Now, however, he tells us that "there are railways from Georgetown to New Amsterdam, and from opposite the capital for fifteen miles on the west coast. There is also a railway nineteen miles long about sixty miles up the Demarara River." Communication by coast and river steamers has also been much improved. At one time Guiana had an unenviable reputation as unhealthy, but Mr. Rodway, who speaks from, as we said before, an experience of forty years, can now say that "Guiana is not now an unhealthy country. There is no yellow-fever, no small-pox, or other epidemic disease, and even consumption is not such a pest as in some other countries. True, there are malaria and dysentery, both of which will, no doubt, be much reduced, if not eliminated, when the drainage is improved, and a better water supply secured for the lower classes." We trust we have said enough to show to our readers, that in the hands of Mr. Rodway the story of Guiana is extremely interesting. He must have had much satisfaction in tracing and depicting the improved conditions of the colony since the time when he wrote his former work. As will be seen from our quotations, he has no hesitation in frankly expressing views diametrically opposed to those he once held, and this mental attitude does credit to his sincerity and impartiality. We must add that he is a careful and judicious guide through the tangled and confusing intricacies of the history of all these territories. The book is well illustrated by a number of excellent photographs, and is equipped with a useful map.

*From Halifax to Vancouver.* By B. Pullen-Burry. London: Mills and Boon, Ltd., 1912. *Price* 12*s.* 6*d. net.*

In this pleasantly written volume the author goes over well-trodden ground, but the story of the history of Canada and the development of its cities and resources is so wonderful and interesting, that in the hands of a skilful writer it can be invested with a perennial charm. The author spent some months of last year travelling over the line of the Canadian Pacific Railway from Halifax to Vancouver, and seeing for herself whatever was possible to be seen in the time at her disposal. She had excellent introductions, which procured for her immediate and ready access to all sorts of places and celebrities, and she used to the very best advantage the exceptional opportunities she had of acquiring information. It is

not quite clear in what capacity she went across the Atlantic. She repudiates the idea that she is an advertising agent, or that she has personal interests in some of the commercial ventures which she commends to the attention of intending emigrants. At Regina she described herself as "an Imperialist, a traveller, and a lecturer," and certainly this volume corroborates her claim to be all three. Her political bias is very evident, but it is not obtrusive. What is most valuable in this work is, we think, that it is so up to date in giving the most recent information as to the present condition and prospects of the localities to which she refers. What may somewhat perplex the intending emigrant is the *embarras de richesses*, for apparently along the whole line of the railway from the one ocean to the other there are ample opportunities for success in all sorts of careers, provided, of course, that certain conditions are complied with, the most essential being that the emigrant is in good health, and really anxious to work. Canada is no place for the wastrel, the loafer, or the idler. There are also certain special dangers in the path of women emigrants to which the author seems to have given special attention, and on which her warnings and advice merit the careful study of all women emigrants. She is moderate and judicious in the use of statistics, using them usually to illustrate the marvellous growth of places and populations. She varies the interest of her subject by brief excursions into history, and by lively anecdotes of personal interviews with officials and residents. The volume is illustrated with a number of beautiful photographs.

## GENERAL.

*The Great Marquis of Montrose.* By Mrs. Hugh Pryce. London: Everett and Co., Ltd., 1912. *Price* 10*s.* 6*d. net.*

"The most poetical chronicler," said the late Professor Aytoun, "would find it impossible to render the incidents of Montrose's brilliant career more picturesque than the reality. Among the devoted champions who, during the wildest and most stormy period of our history, maintained the cause of Church and King, 'the Great Marquis' undoubtedly is entitled to the foremost place. Even party malevolence, by no means extinct at the present day, has been unable to detract from the eulogy pronounced on him by the famous Cardinal de Retz, the friend of Condé and Turenne, when he thus summed up his character: 'Montrose, a Scottish nobleman, head of the house of Grahame—the only man in the world that has ever realised to me the ideas of certain heroes, whom we now discover nowhere but in the lives of Plutarch—has sustained in his own country the cause of the King his master, with a greatness of soul that has not found its equal in our age.'"

The romantic tragedy occurred at a time, most appropriately called "The Troubles," when the bulk of the nation suffered itself to be misled into a semi-religious, semi-political frenzy by fanatics and bigots, under whose skilful manipulation it fully deserved the scathing description afterwards given of it by a dispassionate historian, "The mob, within its own low and rather ineffective sphere, formidable throughout. A Scots mob has ever been a monster signally destitute of good taste, and, it may be said also, of good feeling. It has all the bad qualities of an English mob somewhat intensified. There is, where it is really let loose and acting on its own impulses, the same want of reverence for existing or for fallen greatness. It has the same exultation in heaping degradation, scorn, and low practical sarcasm on its victim. But it has also the same abstinence from the knife, the free use of which makes the mobs of other communities so much more picturesque. Principal Baillie, writing under the influence of the exciting scenes he daily saw, says, 'I think our people possessed with a bloody devil far

above anything that ever I could have imagined, though the mass in Latin had been presented.' Yet the tumults were bloodless save for occasional bruises, and we hear of no life taken in any of them." Many of the nobility were more culpable, because less ignorant, and more self-interested than the common people. Johnston of Warriston, the Mephistopheles of his party, who had by far the most subtle intellect and brilliant abilities on the Covenanting side, shows his appreciation and his knowledge of his comrades, when he concluded his instructions to "my lord Rothes, my Lord Loudon, and the Sherriffe of Tividdaile," when sending them to Berwick to conduct certain delicate negotiations with the King, with these words: "Remember whether warre or peace follow, your cariage in this act will be remarkable in historie, and let it never be said of you as yourselves has many tymes said of some nobles in the land, and that when they parlied anent the tithes and the revocation that everie one looked so to his owne particular accomodation of the King as everie one betrayed another and all betrayed the publick." On the side of the Royalists the outstanding figure is that of Montrose, and after him Lord Napier, the scions of the House of Ogilvie and the Stirlings of Keir. Above them all stands the figure of the weak, vacillating, credulous Charles, who, however amiable, gentle, and pious, was quite unfitted to be king at such a time or over such a people. Unable to make up his mind, and shrinking from all strong measures, he had to be warned by Archbishop Laud to be careful of the contents of his own pockets, which were habitually extracted by his valets and attendants and communicated to his known enemies. The Solemn League and Covenant of 1644 disclosed the real intention of the Covenanters to reduce the royal authority to a shadow. It was evident even to Charles that war was inevitable, and he had wisdom enough to confide to Montrose at the age of thirty two the leadership of the Royalist cause in Scotland. We cannot, of course, trace in detail his meteoric career during the next sixteen years. For this we must refer our readers to the vivacious and eloquent pages of Mrs. Pryce, who is a whole-hearted admirer of her hero, and does not disguise the fact. Her book is based on the works of Napier, Gardiner, Murdoch and Simpson, and Lang, and she has succeeded in painting for us a charming portrait of a national hero and a Paladin of loyalty and chivalry. Alongside of his, and in startling contrast, are more sombre and sinister figures, such as Argyll, Hamilton, Huntly, Warriston, to which must be added that of Queen Henrietta Maria, who persistently ignored the good work and great abilities of Montrose. In the field he was hampered by disloyalty and jealousy, especially on the part of Huntly and the Gordons, by the Highlanders' disastrous habit of returning to their glens with their spoils after each victory, and by the inadequacy of the support which he received from his royal master. It is a glorious although a sad story, and Mrs. Pryce tells it well.

*Book of the Knowledge of all the Kingdoms, Lands, and Lordships that are in the World, and the Arms and Devices of each Land and Lordship, or of the Kings and Lords who Possess them.* Written by a Spanish Franciscan. Translated and edited by Sir CLEMENTS MARKHAM, K.C.B., Vice-President of the Hakluyt Society. London: Printed for the Hakluyt Society, 1912.

In this, the latest publication of the Hakluyt Society, we have the more or less veracious story of a mysterious Franciscan friar whose identity has not yet been discovered, and probably never will be. He lived in the first half of the fourteenth century, and starting from Seville he appears to have made a tour round the world so far as it was then known. It is certain that at times he drew on his imagination, as when he states that in Tartaria in the empire of Catayo, "I lived for some

time in that castle of Magot (*i.e.* Magog) because I heard and saw marvellous things every day." But the learned translator and editor of the work, Sir Clements Markham, whose authority is unimpeachable, credits him with being a true explorer and contributor to original research. He says, "From a geographical point of view the work of the Franciscan is important, because he was the first to describe the Canary Islands, Madeiras, and Azores; and because he was the first to give an account of Africa south of the Atlas in any detail. He gives a clear and precise definition of the famous Rio del Oro, the Niger of Ptolemy and Pliny, the Nil Gana of the Arab geographers, and the modern Senegal. He goes on to describe Sierra Leone and the Gulf of Guinea. All this is so exact that it bears the appearance of being based on personal knowledge." A most interesting feature of the work is the very complete collection, admirably reproduced in colour, of the arms, flags, and devices of each of the countries visited, including even the flag of the mythical Prester John, whom the friar located in the town of Malsa in Ethiopia, where he again "saw and heard marvellous things every day." His references to Scotland and England are characteristically and provokingly meagre. "We came to the island of Escocia, and found in it four cities, one called Donfres (*i.e.* Dumfries), another Eneruic (*i.e.* Edinburgh), another Veruic (*i.e.* Berwick). The king of this Escocia has for his device a red flag with three long lions of gold. I departed from the land of Escocia and came to the kingdom of Inglaterra. Know that it is a very well populated country, and that it contains eleven great cities. The largest, where they crown their king, is called Londres, and another Gunsa (Windsor?), where are the general studies, another Antona (*i.e.* Southampton), others Bristol, Artamua (*i.e.* Dartmouth), Premua (*i.e.* Plymouth), and Miraforda (*i.e.* Milford). In a province they call Gales there is a great city called Dirgales, which is a lordship of Inglaterra."

*Studies in Bird Migration.* By William Eagle Clarke, Keeper of the Natural History Department, the Royal Scottish Museum. With Maps, Weather Charts, and other Illustrations. 2 vols. London: Gurney and Jackson, 1912. *Price* 18*s. net.*

We would give a hearty welcome to this book, which has been so long looked for. It is the outcome of thirty years' observation and research, and if genius be *la patience suivie* it is here. Of all the days and nights spent in lighthouses and lightships and lone islands of the sea, and of all the very different—very dreary—days and nights spent over the analysis of the vast data collected by the British Association Committee, we have here the fruits, and Mr. Eagle Clarke is to be congratulated on the completion of the most important contribution that has yet been made to the study of the migration of birds.

The book is not of the nature of a treatise gathering together all that has been established by various methods of inquiry, it is rather a series of personal studies embodying the author's own observations and inductions. Perhaps, indeed, in pursuing this method the author has been almost too reserved, for we find his chapter on "Some Modern Views" tantalisingly short. But this restraint is of course deliberate, and those who know the fascination of the subject and its provocativeness to the speculative and the romantic alike, will appreciate the author's almost invariably tight rein. The work is a model of clear exposition and careful writing, and while it necessarily contains much that is for reference rather than for reading, it will interest many besides ornithologists. It begins with a chapter on antiquated views, such as the theory of "hibernation" which Aristotle propounded, which led even Linnæus and Gilbert White astray. The second chapter deals

with some modern views, and is intended as an introduction to the special studies which follow. The author then passes to consider the British migratory birds (summer-visitors, partial migrants, winter visitors, and birds of passage), the geographical aspects of British bird-migration, the migration-phenomena of the seasons and the influence of weather on migration. Then follow chapters dealing in detail with the migrations of swallow, fieldfare, white wagtail, song-thrush, skylark, lapwing, starling, and rook. The remaining ten chapters relate the author's observations on the Eddystone, on the Kentish Knock lightship, at Fair Isle ("the British Heligoland"), at St. Kilda, the Flannan Isles, Sule Skerry, Ushant, and the Channel Islands. The chapters are illustrated with charts and photographs, and there is a fine picture by Marian Eagle Clarke of the Eddystone lantern surrounded by a cloud of birds.

Let us essay the rash task of giving a few samples of Mr. Eagle Clarke's suggestions and conclusions. It is suggested (p. 22) that flying by night is resorted to because most of the daytime has to be devoted by birds to the search for food. The author does not believe that any species of migrant exceeds 100 miles per hour, and he doubts if such a speed is maintained (p. 25). A "special sense of direction" guides the migrants, "though they know it not, and enables them to reach the seasonal homes of their respective forbears, wherever they may be" (p. 27). "It may be asserted without fear of contradiction that no country in the world is more favourably situated than our own for witnessing the movements of migratory birds; that there is none in which the many phases of the phenomena are of a more varied nature" (p. 30), and the reason for this pre-eminence is geographical. "The ordinary observer, until lately at least, never thought birds usually considered residents were represented in our islands by a sedentary and a migratory race" (p. 34). It is now possible to map out some of the main routes of British migratory birds in the vicinity of the British Isles (chap. iv.). One of the characteristics of the spring migration is that "the males, the more ardent suitors of most species, travel in advance of the females and arrive at the nesting quarters some days, it is said in some cases even weeks, before their consorts" (p. 105). "The autumn retreat towards winter quarters is a leisurely performance in marked contrast to the feverish rush to nesting haunts in the spring." The exceedingly valuable chapter on the meteorology of bird-migration, in which the author has had the assistance of Dr. W. N. Shaw, Director of the Meteorological Office, disposes of not a little current error and lays a solid foundation for further construction. "The type of weather which prevails when the winds range from south to east, and especially when they are south-east, is the most *favourable* for migratory movements between the British Islands and Continental Europe, in both spring and autumn. The weather conditions prevailing when the winds vary from west to north are the most *unfavourable*, both for immigration to and emigration from the British Isles (p. 172). "Every migratory movement has its own particular and peculiar meteorological associations, for the conditions controlling them are often of a more or less complex nature. Most of them admit of explanation when the official weather reports, which afford the key for their solution, are consulted" (p. 181). Those who rush unpreparedly into the discussion of the relation between wind and migration-flight, will find food for reflection in Mr. Clarke's careful treatment (which represents the condensation of enormous labour), and we would recommend to their consideration, what is pointed out on p. 173, that the *direction* of the wind has in itself nothing to do with the migratory movement.

But it is plain that this method of sampling cannot be extended to what forms the greater part of the book—the account of the migration of representative birds

and the account of the migration phenomena at representative stations. We shall therefore conclude our appreciation of this important contribution to zoology by quoting from the chapter on the Eddystone a passage which illustrates another kind of quality. "Throughout the movement, and especially when it was at its height in the earliest hours of the morning, the scene presented was singular in the extreme and beyond my powers of word-painting. Hosts of glittering objects, birds resplendent, as it were, in burnished gold, were fluttering in, or crossing at all angles, the brilliant revolving beams of light. Those which winged their way up the beams towards the lantern were innumerable, and resembled streaks of approaching light. These either struck the glass, or recovering themselves passed out of the ray ere the fatal focal point was reached. Those which simply crossed the rays were illumined for a moment only, and became mere spectres on passing into the gloom beyond. Some of those that struck fell like stones from their violent contact with the glass: while others glanced off more or less injured or stunned, to perish miserably in the surf below. Others again beat violently against the windows, in their wild efforts to reach the source of the all-fascinating light. Many of those that freed themselves from the dazzling streams of light came in contact with the copper dome of the tower, making it resound like a drum, and then fell like flashes into the water below, followed slowly by a cloud of feathers, resembling a miniature shower of golden flakes. Finally, above and below the madding crowd in the illumined zone, great numbers of the migrants flitted around in all directions in the semi-darkness, and in almost weird contrast with the brilliant multitudes gyrating in the adjacent vistas of light. The babel of tongues, too, was a very striking feature. These were by no means the cries of enchantment, but of surprise and alarm; and they varied from the loud rattling notes of the blackbird and the harsh angry "churr" of the mistle-thrush to the faint and dainty twitter of the goldcrest. Some skylarks every now and then, under the impulse of excitement, no doubt, broke out into a few notes of song. . . ."

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# THE SCOTTISH GEOGRAPHICAL MAGAZINE.

## THE COMMERCIAL DEVELOPMENT OF SPITSBERGEN.

By R. N. Rudmose Brown, D.Sc.

(*With Illustrations.*)

The commercial development of Spitsbergen began shortly after its discovery in 1596, and was in fact the sole motive for its exploration for two centuries. The whale-fishing in the bays, and later in the open seas, and the walrus-hunting were for long the only valuable activities pursued there. About the middle of the eighteenth century seems to have begun the exploitation of Spitsbergen for the skins of seals, reindeer, and foxes. White whales also began to be an object of the chase. The chase was at first the work of summer visits, but before long the hunters took to wintering in order to obtain the valuable winter coats of bears, foxes, and reindeer. This hunting continues to-day, but probably culminated about five years ago. Small wintering-parties of two, three, or four were then scattered all round the shores of Spitsbergen, but particularly on the west side and up Ice Fjord. There is scarcely a favoured site on the west coast where either an existing hut or the ruins of one is not to be found, while numerous graves tell of the heavy toll of scurvy.

In the early days of this occupation fur-bearing game was plentiful, but as the price of furs rose the number of hunters increased, with serious results to the fauna of Spitsbergen. Polar bears, blue and Arctic foxes were principally sought for, and were originally caught by means of traps; then as the animals became more wary and their numbers decreased other less legitimate means were resorted to. The employment of poisoned bait was very common a few years ago, and wrought havoc among the wild life of Spitsbergen. No doubt its use added to the hunters' take of skins, but scores of foxes and bears who

had partaken of the poisoned meat must have crept away to holes and corners to die, and their lives have been uselessly sacrificed. Birds also became infected with the poison, and probably even the vegetarian reindeer did not escape. The writer has found in numerous places in Spitsbergen dead white foxes in their winter coats, and gulls also, the victims of the dastardly devices of these hunters. These hunters, who nowadays are all Norwegians, have been steadily decreasing in numbers in recent winters, for large tracts of country are almost depleted of their game.

It is said that the hunters themselves are now averse to the use of poison, and that the Norwegian Government has put difficulties in their

Hunter's Winter Hut.

way of obtaining it, but its employment probably continues. In any case, the harm is done now, and hunting, at least on the western side of Spitsbergen, will soon be a thing of the past. This summer we marched for three days through one of the wildest parts of Spitsbergen, ideal reindeer country the whole way, and saw not a single reindeer nor even the tracks of a recent one. Nor did we hear, much less see, a single fox in places where they swarmed less than ten years ago. In Prince Charles Foreland it is the same. Three years ago the expedition in the *Conqueror* saw none on that island, where Dr. W. S. Bruce recorded their great abundance two years before. As regards the reindeer, Norwegian hunters, heavy as is their guilt, are not alone to blame. Numbers of so-called sportsmen have been in the habit of visiting Spitsbergen in July and August to shoot reindeer, slaughtering as many as they can contrive to hit, and leaving them as they fall. In one valley we saw at

least ten carcases from which neither skin nor horns had been removed, obviously the work of unsportsmanlike butchers and not of profit-seeking hunters. It is only because the reindeer have become shyer and scarcer that this practice is ceasing.

Legitimate hunting is permissible, but these practices must be put a stop to, and that speedily, or Spitsbergen will be a lifeless desert before long.

Bird-life is still abundant, probably because it neither pays nor amuses any one to molest it. Considerable profits are obtained from the eider duck, whose down is annually collected in many places and fetches a good price. The geese are as numerous as ever, but the extremely tame ptarmigan have greatly diminished. Other birds appear to hold their own.

On the east and north coasts there are still reindeer, bears, and foxes in abundance, but fortunately they are difficult of access. The hunters avoid the east coast, since ice has often prevented the relief of wintering-parties on that coast in the following summer. More than one party has had to escape by crossing Spitsbergen to the west coast, which entailed the abandonment of all or most of the skins. If it were not for the likelihood of this eventuality hunting would be profitable enough on the east coast. Last winter a party of some four hunters who erected their hut near the South Cape took ninety-three bears besides other game. A few years ago six men are said to have taken on Wyches Land about £2800 worth of skins, which, on the failure of relief to reach them, they were forced to abandon in the second year in order to travel by boat and foot over ice and land to Advent Bay.

In some of the valleys opening to the north coast reindeer are still frequent, but in Advent Dale, Sassendal, and adjacent valleys, the best reindeer land in Spitsbergen, they are seldom seen nowadays.

No doubt as game becomes increasingly scarce there will be a corresponding diminution in the number of hunters, and so possibly reindeer and foxes will thus escape extermination, but nevertheless a close season is sorely needed, and it should be for five years at least.

The walrus has long been extinct on the west coast, but still persists on the east, and about Wyches Land and Hope Island. The white whale is fished in Ice Fjord principally, but hunters complain that during the last two years there has been too much ice about in summer to allow of its pursuit.

Bear Island has experienced the same fortunes as Spitsbergen, but being so small has been almost cleared of game. The last winterers on it, a year or two ago, made but small profit from their stay.

Whaling still persists in Spitsbergen, and recent years witnessed a revival of it. By the middle of the seventeenth century the bay whale-fishing was practically over, and all that remained was the open sea whale-fishing. During the nineteenth century this was chiefly concerned with the right whale, but it had nothing to do with Spitsbergen. For the last few years, however, finner whale-fishing has revived. Steam whalers have worked off the coasts, and towed the whales into shore stations for boiling down. Schoonhaven (Recherche Bay) in Bell Sound

was the site of the shore station for a year or two, but it is unsuitable for the purpose, since it is liable to be blocked with ice drifted round the South Cape. Consequently it was replaced by Green Harbour, where a large whaling-station has been established for a few years. Last year over one hundred whales—finners chiefly—were dealt with at this station, but this year only twenty-five had been caught up to the end of August. So bad had been the season that old, discarded carcases lying about the beach had been dug up and utilised in the factory for oil and bone manure. No doubt the bad weather experienced this summer had something to do with the lessened catch, but a growing scarcity of whales is the chief cause, and will probably entail the abandonment of the station this autumn. On the opposite side of Green Harbour is a floating "cook-ship," the headquarters of the second and only other whaling company in Spitsbergen. It also had experienced a bad season.

It seems probable, then, that whaling in Spitsbergen waters will cease once again this year.

While hunting on land and sea is thus waning in Spitsbergen, a new era in the exploitation of the country is opening. The development of the mineral resources bids fair to outdo in importance all other forms of activity.

Not only is there a considerable variety of geological formations in the comparatively small area of Spitsbergen, but the numerous long fjords give a great area of accessibility. Moreover, the greater part of Spitsbergen, including Barents, Edge, and Hope Islands, as well as Bear Island, is an eroded table-land, so that the majority of the strata are nearly horizontal, which facilitates the working of any minerals that occur. Along the western side most of these beds are steeply upturned by a long fault against the Silurian rocks of the Hecla Hook series, which form almost the whole of the west coast and of Prince Charles Foreland.

So long ago as 1872 mining operations were begun in Spitsbergen, but it is only within the last ten years or thereabouts that much has been done. Every summer now finds new prospectors in the field, and there are few parts of the west coast and its fjords that have not been visited and examined, and probably none of any value that have not been laid claim to.

In a country which is a *Terra nullius* there are few formalities between the discovery of mineral deposits and the appropriation of the land. A notice-board stating the claim and defining its area is all that is required, and all that it is possible to do. The shores of Ice Fjord in places are studded with such boards at no great intervals—some old, others new; some in relation to rights still maintained, others to abandoned claims. But simple as it is to make a claim to land, security of tenure is quite another matter. There is nothing to prevent a newcomer "jumping" a claim: this has occurred in more than one case, and is likely to be done with increasing frequency as the more desirable territory becomes taken up. In the present state of Spitsbergen custom and unwritten law are alone of any service in establishing territorial

rights, and there is no power to compel rival companies and prospectors to obey these canons. It is, however, generally recognised that provided a man claims a reasonable area, his claim is respected if he does any work on it within two years' time, or erects buildings. Otherwise a claim is recognised as lapsing, and the territory as being free to whoever may desire it. This is not an altogether unsatisfactory basis, but it leaves considerable scope in interpretation, and even in its most restricted sense is not always respected. In various parts of Spitsbergen there are instances of flagrant violation of custom as regards the right to territory, and nowhere is this more outrageous than the recent annexation by a Norwegian company of territory claimed and worked by a British company in Advent Bay.

Coal is the principal mineral worked in Spitsbergen. Its existence has been known for a considerable time. In 1610 Jonas Poole, a Hull walrus-hunter, discovered in King's Bay "Sea-coales, which burnt very well." The geological exploration of Ice Fjord and the west coast dates from some thirty years ago, but no doubt long before that the coal in Advent Bay had been discovered. For many years whalers were in the habit of digging small quantities in King's Bay and Bell Sound to replenish their supplies. Some stranded hunters obtained coal in Advent Bay in the winter of 1895-96. Twenty years ago Cremer made a study of the coal beds in Advent Bay and King's Bay, while in 1898 Dr. W. S. Bruce brought back samples of the Advent Bay coal which on analysis proved to be extremely good. Sir Martin Conway records that in 1899 a Norwegian skipper brought away from Spitsbergen a cargo of coal. In 1905 the Arctic Coal Company of Boston, Mass., U.S.A., was formed by Messrs. Ayer and Longyear, and bought from Norwegians existing claims of some two years' standing on the southern side of Advent Bay. Here is a three-foot seam of Tertiary coal, free from "dirt," and equal in use to the best Welsh steam coal.[1] This seam dips gently to the south-west, is brought up by a fault in Coal Bay, and outcrops again along the eastern side of Green Harbour, where numerous claims have been established and there is considerable clashing of acquisitions. In Advent Bay the Arctic Coal Company are working the seam, at a height of about 400 feet, by a level adit. From the pit mouth the coal is taken down to the head of the bay by a wire ropeway, which terminates on a wooden jetty where steamers are loaded, either direct from the ropeway or by a short tramway from a store heap near the beach. Export of coal began some three or four years ago, and this year is said to have amounted to over 40,000 tons. The company's own wooden steamer *W. D. Munro* and several chartered iron vessels are engaged in carrying this coal to Norwegian ports. The *W. D. Munro* manages to get into Advent Bay every year before the end of June, and makes her last south-

[1] The following analysis of Spitsbergen coal by Mr. W. H. Patterson appears in the *Chemical News*, cv. p. 277 (1912). Presumably it refers to the Tertiary coal, mined by the Americans, though that is not stated: Moisture, 1·99; Carbon, 79·79; Sulphur, 0·76; Oxygen, 8·4; Ash, 2·52; Hydrogen, 5·45; Nitrogen, 1·08. It is described as a "very pure coal" "with relatively little moisture and a high calorific value." No sign of either pyrites or calcium carbonate was found.

ward trip during the first half of October. But though the export has all to take place during the three summer months work continues throughout the winter. On the northern side of Longyear Valley is the mining settlement of about twenty large wooden houses along either side of a "street," along which is a tramway track to the jetty about a third of a mile away, by which stores are easily brought to the settlement. As many as 300 men are employed here in summer, and perhaps 100 or more in winter. These miners are at present chiefly Norwegian, with British foremen and American engineers in charge. The "camp" has an air of bustle and prosperity in strange contrast to the silence of the unexplored fastnesses near at hand. Considering the short season during

Arctic Coal Co.'s jetty and SS. *Munroe*, Advent Bay.

which building work can be carried on, it is wonderful what progress has been made. Much growth and improvement are noticeable within the last three years. To ensure an absence of scurvy, fresh meat is plentifully used throughout the year. Cargoes are brought from Norway and stored, but there are in addition 100 live pigs, that seem to prosper splendidly, and a few cows. Poultry do not appear to do well, but several horses are always kept at the "camp."

In addition to the export of coal in bulk many vessels call at the mine for bunker coal. Whalers from Green Harbour, tourist boats, a few yachts, and an exploring vessel or two—some or other of these, together with a coal boat and perhaps a hunting-sloop, are generally to be seen lying in Advent Bay, and give an animated appearance to this centre of civilisation in over 78° N.

During summer frequent communication is kept up with Tromsö by

the coal boats, but during winter the settlement is cut off, though occasional visits are received from wandering hunters or other mining camps. This winter, however, an installation of wireless telegraphy will be in operation linking Longyear City with the powerful station which the Norwegian Government erected last year in Green Harbour. The Green Harbour station is in connection with Ingö in the north of Norway.

The Arctic Coal Company claims a considerable area of land from the Sassendal to Green Harbour, and in the latter place are starting an adit into the same seam as in Advent Bay. In Longyear Valley a second adit is being started this year. This company has the most developed mining

Longyear Valley City, Arctic Coal Co.'s Settlement, Advent Bay.

interests in Spitsbergen. Across Advent Bay, on its north-eastern side, is the territory of a British company, the Sheffield Coal Company.

This company, which started operations in 1903, has run a slightly dipping adit at a height of about 150 feet into a seam of Jurassic coal. This side of Advent Bay is built of Jurassic rocks with outliers of Tertiaries capping the highest hills. The British company have never mined the coal which occurs in the Tertiary rocks, and their Jurassic coal is not of the same quality nor so pure as that mined by the Americans, yet it is of a fair quality. The disadvantage which the British company labour under is the exposed nature of the anchorage off Advent City, and the consequent difficulty of loading coal at the pier. The anchorage is untenable during westerly and south-westerly winds; in fact, it is well sheltered only from easterly winds. Operations ceased here over four years ago, but previously to that a good deal was done. The settlement consists of over a dozen exceedingly well-built log houses with a con-

siderable amount of mining and electric light plant and a tramway down the hillside from the coal mine to the end of the jetty. The company also owns several huts in Advent Dale, where attempts were made to mine iron ore.

The present state of Advent City is an illustration of the lawlessness and insecurity of property which obtain to-day in Spitsbergen. Little more than the frameworks of the houses remain standing; windows and doors have been smashed, and stores wantonly destroyed.

Sheffield Coal Co.'s mine and tramway, Advent Bay.

Everything portable and of value has been carried away; what is left has been wrecked. This disgraceful treatment is what every other temporarily abandoned mining settlement may suffer if Spitsbergen remains neutral territory. But an even more flagrant act of aggression has been committed at Advent City this summer. A Norwegian company has erected boards intimating that they have "annexed" this British territory, settlement and all. Here, at least, is an action in which the culprits have not remained anonymous. To regard such conduct in the most lenient light, however, it shows the dangers which mining companies have to contend with in their attempts to develop territory.

Another British mining company has large deposits of coal, presumably Tertiary, in Lowe Sound, where important developments have been taking place since 1906. Attempts have also been made by a Swedish company to work this coal in Braganza Bay, but access to that bay is always difficult on account of ice and probably this will hinder the undertaking. In Klaas Billen Bay, at the small bay on the west called Miners' Bay, a mine has been started this year in what would appear to be coal of carboniferous age. Provided the coal proves good enough there is no reason why this mine should not be successful. Lastly should be remembered the numerous experimental openings one sees in the Tertiary seam of coal along the eastern side of Green Harbour. The confusion of claims here has already been mentioned, but two companies have actually started work and already got out a few tons. As yet, however, the work has been done on a small scale, but the proximity of this harbour to the sea and its excellent anchorage should make it a most favoured place for a coal mine.

A word may be added here regarding Bear Island which enjoys the same immunity from political control as Spitsbergen. Carboniferous coal-bearing strata occur there, and though they have been prospected and claimed no mining is being done at present. Export would be the great difficulty since there is a want of sheltered anchorage. North Harbour would have to be used, but this could only be done if it were protected by a breakwater. In some years, moreover, drift ice would be a menace to shipping in the early summer.

Coal-mining may be the most important of the present-day occupations in Spitsbergen, but it is by no means the only one. It was in 1872 that a Swedish company began to mine concretions in the shales of Triassic age near Cape Thordsen, Ice Fjord, in search for phosphates. They built a large house and workshops and a quarter of a mile of tramway to the sea. The enterprise was not a paying one, however, and was abandoned the same year. This house has had a varied history since, but is still standing. The winter after its abandonment seventeen walrus-hunters, whose sloops had been caught in the ice in the north of Spitsbergen near Red Beach, made for this house to winter in knowing of the store of provisions left there. Lack of exercise and a superabundance of preserved food was fatal to them all, and next year seventeen bodies were found in and about the house and now lie buried in an adjoining grave. In 1882-83 the Swedish Meteorological Expedition wintered in this same house. Three years ago the writer camped near by with Messrs. Miller and Hannay. The house was not then in good repair, the mossy foundations were giving way, but worse was the damage done by Norwegian hunters.

King's Bay is the scene of much activity nowadays. Not only is there some tentative coal-mining, but a British company is employing a number of men in quarrying valuable marble. This is said to be of fine quality and of various colours, and the quarries promise to become a centre of great activity in a year or two. There is an ideal harbour in the immediate vicinity, perhaps the best in all Spitsbergen. Lastly it must be noted that in Prince Charles Foreland and Sassen Bay and Temple Bay are large areas claimed by a Scottish company. Two

small houses were erected on the Foreland claims in 1907 and 1909 respectively. Altogether some 7000 square miles of Spitsbergen are claimed in British interests.

Every year sees further economic developments in Spitsbergen, and as the useful areas on the west become staked out the north and east will be visited and exploited despite the difficulties of access, particularly to the east, in many years. The exploitation of Spitsbergen so far—if we omit the whaling and hunting—has been in the hands of Britons, Americans, Swedes, and Norwegians, but Russians and Germans are already looking anxiously for claims. A large Russian expedition was in the field this year, but does not seem to have acquired any territorial rights. Land, however, has been taken in Cross Bay in German interests.

While the lack of political ownership in Spitsbergen leaves mining free from taxation and kindred troubles, these considerations are more than outbalanced by the insecurity of tenure and the absence of any form of law except usage and might. It is a state of affairs that will not continue much longer. Norway and Russia each show most conclusively what their ambitions are, and Sweden is not behindhand. The Norwegian Government, as was mentioned above, has erected in Green Harbour a powerful wireless installation which communicates with the north of Norway. A staff of six men is maintained here all the year round, but except as a convenience for the mining-camps and for the amusement of a few summer tourists the station is of little use. Certainly its earnings can never justify the cost of its erection, nor even pay for its upkeep. The same Government maintains a so-called mail service at infrequent intervals during the summer months. The mails are carried from Tromsö to Green Harbour by a subsidised motor fishing-boat of twenty tons—the *Dion*—which makes the journey in any time from four days to a week. There is no delivery beyond Green Harbour, and the Americans, who in virtue of the numbers in their settlement might benefit most by this service, do not make use of it, but carry their own mails with greater regularity and frequency to and from Tromsö. At the Norwegian wireless station is a Norwegian post-office at which letters are accepted at Norwegian postal rates and with Norwegian postage stamps.

Finally, it should be noted that Spitsbergen is not as far from Europe as is usually supposed by those unacquainted with the facts. Mercator's projection is largely responsible for this apparent great distance. Nor is it as inaccessible as its inclusion in the polar regions might suggest. Ice Fjord, the centre of the most important coal-mining activity, is only some 1200 miles from the Orkneys and less than 500 miles from Tromsö. The warm Atlantic drift keeps the west coast clear of solid pack, while one or two icebreakers could easily keep open the western harbours in the winter and ensure navigation all the year round.

There may be difficulties in the way of exploiting the mineral resources of Spitsbergen, but they are minor ones as far as climatic questions are concerned. The mines are easily worked during winter with the help of electric light, and the continuous summer daylight

allows out-of-door work to be pushed on rapidly at that season. Labour and provisions have, of course, to be imported, but most mining districts have to contend with these difficulties. On the other side must be put the extreme healthiness of the climate and its invigorating nature. The one great hindrance to Spitsbergen being drawn into the sphere of modern commerce is the want of ownership by a strong power which can make and enforce the necessary laws.

Nor should it be forgotten that Spitsbergen has a great strategical value from a naval point of view. Its splendid harbours, unlimited supply of coal, and proximity, with an open route, to western Europe, make it a land that should not be overlooked. In point of fact, more than one power is showing considerable interest in Spitsbergen to-day.

These notes on the present state of Spitsbergen are based on two personal visits, in 1909 and in 1912, during which practically all the centres of mining were inspected. In addition I have drawn freely on Dr. W. S. Bruce's unrivalled knowledge of Spitsbergen. The view of Longyear Valley City has been kindly supplied by him.

## GEOGRAPHY AT THE BRITISH ASSOCIATION.

The Dundee Meeting of the British Association opened on Wednesday, September 4, with the delivery of the Inaugural Address by Professor E. A. Schäfer. A sensational announcement made at this meeting by the Lord Provost was that Dr. J. K. Caird, of Dundee, had presented the sum of £10,000 to the funds of the Association, a gift unfettered by any conditions whatsoever.

On the following day the sectional meetings began. Geography, together with Anthropology, found a home in the Young Men's Christian Association Rooms, Constitution Road, within a few minutes' walk of the Reception Room in the Albert Institute, but a considerable distance from University College, where a number of the other sections were placed.

The proceedings in Section E were opened by the delivery of the Presidential Address by Colonel Sir Charles M. Watson, this address being printed in full in our last issue (p. 505). This was followed by a paper on the "International Map of the World" by Colonel C. F. Close, which in the unavoidable absence of Colonel Close was read by Captain Henrici. It gave rise to a very interesting discussion, especially in view of the criticisms of the published sheets contained in the Presidential Address. Specimens of these sheets were on view, and an examination of them showed both the difficulties which present themselves, and the methods adopted to obviate these so far as possible. In regard to the detailed criticisms made by the president, it was pointed out that the resolutions of the Committee allowed a certain latitude in the colouring and contouring of the maps, and that the differences noted between the colouring of the published sheets had been found necessary owing to the differences of relief in the countries

concerned. The other criticism dealing with the fact that not all parts of the world have been accurately mapped, and that the sheets might therefore convey an impression of greater accuracy and more detailed knowledge than actually existed, was met by pointing out that each sheet contains information as to the sources from which it is compiled, so that persons using the individual sheets can form an idea of the probable accuracy of the facts represented.

Among those taking part in the discussion was Colonel Sir Duncan Johnston, who spoke against the attempt to introduce the metric system into British maps, and criticised the classification of roads adopted, on the ground that the attempt to introduce all the roads of the types mentioned, on the sheets representing civilised countries, would lead to dire confusion. In his reply Captain Henrici pointed out that in this, as in many other respects, the resolutions of the Committee represented a compromise. It is, of course, impossible to show, *e.g.*, all the roads of Midland England on the English sheets, but, on the other hand, it is very undesirable to show rough paths in uncivilised countries as if they were well-made roads. A classification of roads is thus absolutely necessary, but in densely-settled countries the producers of the maps must exercise a certain discretion as to what is included and what omitted.

The following is the abstract of Colonel Close's paper. It summarises the various facts connected with this map, most of which have, however, already been mentioned here.

As is well known to all geographers, the International Map was definitely standardised by the labours of an official International Committee which held its meetings in the Foreign Office, London, in November 1909, and issued a report which was published by the British Government, at whose invitation the Committee was assembled.

The following countries were represented on the Committee: Austria, Austria-Hungary, France, Germany, Great Britain, Australia, Canada, Hungary, Italy, Russia, Spain, and the United States. The Committee was the crowning result of the work of many geographers spread over many years. Professor Penck in 1891 first suggested the scheme, it was again brought forward in 1893 by Professor Brückner, and it was discussed again in 1895; but the most important step was not taken until the meeting of the Geographical Congress at Geneva in 1908, when the delegates of the United States proposed that arrangements should be made to standardise the Map, a proposition which was agreed to unanimously.

The chief characteristics of the International Map, as defined by the resolutions of the Committee, are uniformity, accuracy, and reliability.

First, as regards uniformity, the adoption of the Greenwich meridian and the metre made the scheme a possible one, but with reference to the use of the metre there is a proviso that countries using other national units may add the values of the heights in these units if they desire. Whilst dealing with uniformity, it should be mentioned that a certain flexibility has wisely been allowed. Thus, although the normal interval of the contours is 100 metres, in hilly districts intervals of 200, 500, or 1000 metres are permitted, and in very flat countries intervals of 10, 20, or 50 metres. Another important point to note is that although the normal edition is a "layer" map—*i.e.*, one in which successive altitudes are

indicated by a system of colour tints—it is laid down that other editions may be published without these tints—a reasonable concession to those who dislike layer systems.

Next as to accuracy, M. Ch. Lallemand, who was one of the representatives of France on the Committee, has worked out the errors involved in the system of projection which has been adopted. His report has been published by the sister association in France—namely, the Association Française pour l'Avancement des Sciences, of which he was recently president. M. Lallemand finds as a result of his investigation that "the errors, whether linear or angular, of the mode of development adopted for the International Map on the 1 : 1,000,000 scale, are *practically negligible*, and can give rise to no difficulties in the assembly of a group of neighbouring sheets. These deformations, inherent in the construction, are, in fact, much smaller than the hygrometric deformations of the paper on which the map is printed."

As to reliability, the Committee laid stress on the necessity of obtaining the best information available, and expressed the hope that any country producing a map covering portions of neighbouring States would consult the Governments of those States "on the subject of the material available, especially as regards the nomenclature." No one will deny the importance of this proviso, which is being acted upon. In order, also, to insure reliability and to reduce the personal element to a minimum, the Committee adopted contouring as the framework for the exhibition of vertical relief and altitude tints for the principal edition : it excluded hachuring and confined the use of shading to the representation of minor features. The governing idea was clearly that the information given on the map should be as definite and precise as possible.

The total number of sheets required to cover the whole world, including the oceans, is 2,084. If, for the present, we omit consideration of the oceans, the number of sheets to be produced is equivalent to about 500 "full" sheets—*i.e.*, sheets entirely representing land. This will serve to give an idea of the amount of work to be done.

And now for a very brief account of the present state of the undertaking.

At present five sheets are actually on sale to the public, one sheet of Northern France produced by the Service Géographique de l'Armée, two sheets of Scotland produced by the Ordnance Survey, one sheet of Turkey, and one of South Africa produced by the Geographical Section of the General Staff. The latter was chosen to show the system of tints under the most trying conditions. In addition, it is known that sheets are in course of production by the authorities of Hungary, Italy, Spain, and the United States, and two more sheets of the United Kingdom are being produced by the Ordnance Survey.

Most of the countries of the world have expressed their approval of the resolutions, the only adverse official criticism having been received from Sweden. Official letters approving the scheme have been received from the Governments of Belgium, Bolivia, Brazil, Bulgaria, Chile, Colombia, India, Japan, Mexico, Norway, Portugal, Siam, Uruguay, and others. The Government of Japan, which sent no delegates to the Committee, has, since the publication of the Report, expressed its approval of, and adherence to, the scheme. The International Map is, in fact, well under way.

The rest of the morning suffered severely from the attempt to include more papers than time permitted. There was no afternoon meeting, and no less than four papers were down for the morning session,

including the President's Address, which is traditionally somewhat lengthy. The result was that Mr. Reeves's paper was somewhat abruptly abbreviated towards the close, while Dr. Ami's was given with great rapidity to an audience obviously balancing the claims of lunch against additions to their geographical knowledge. As time went on the scale went down more and more against the latter, and the exits were frequent and disturbing.

The first paper was by Mr. E. A. Reeves on "New and Improved Instruments for Geographical Surveying," and was necessarily somewhat technical in character. It was accompanied by an exhibition of apparatus, including a cheap set for the use of schools, but unfortunately the want of time prevented any examination or discussion of these by the teachers present. The following is the abstract of the paper furnished :—

The principal part of this paper consisted of a brief description of some of the more important improvements in instruments for geographical surveying that have recently appeared.

Among the subjects dealt with were : Recent experiments in the determination of longitude ; night illumination of distant points in triangulation : lamps for reading various forms of theodolites ; Invar tape ; latest watches for astronomical observation : lamps for reading theodolite angles : Zeiss and other forms of reflecting levels. After referring to the above, which have to do with astronomical observation, triangulation, and levelling, the paper passed on to describe briefly the latest instruments for filling in topographical and geographical details, such as the plane-table and recent forms of telescopic alidades : photographic surveying, and the latest work done by the method : the stereo-plotter ; Orel's stereo-autograph : introduction of radium paint for illuminating compasses : the astronomical compass and its use in connection with prismatic compass-mapping, where the local attraction is uncertain. Finally, this section finished with a description of a new night-marching watch, which consists of a simple arrangement fitted to an ordinary watch to enable a traveller to march on any desired bearing by the stars at night.

At the end of the paper a set of models of instruments was described which can be constructed at little cost, but which are sufficient for teaching the principles of geographical surveying and field astronomy in schools. These included a theodolite, sextant and artificial horizon, level, tachiometer, and compass.

Dr. H. M. Ami's paper was illustrated by an exhibition of maps and a display of some fine lantern slides. No abstract was furnished, and the paper was devoted to some account of the scenery and development of Canada. As already indicated, it suffered greatly from the haste with which it had to be delivered.

On Friday, September 6, the proceedings in Section E opened with a paper by Sir H. G. Fordham, entitled "Notes on British and Irish Itineraries and Road-books." The abstract of this paper follows :—

In this communication the author endeavours to establish the value and interest of itineraries and road-books in relation to both geography and bibliography, and to trace their development and characteristics from the first publication of such works in the British Isles, late in the sixteenth century, until the advent of the railway system put an end in the middle of the nineteenth century.

for the time at all events, to this species of literature. As a preliminary note to the study of British itineraries he draws attention to the early French publications of this character, which go back at least to as early as the end of the fifteenth century, and of which traces are associated with the religious pilgrimages of the early mediæval period, and particularly to the series of *Guides* published in Paris by Charles Estienne from 1552 onwards. He reviews the periods and classification in point of time to which the growth and character of road-book literature can be attributed, and indicates its relation to the historical development of cartographic science, and of exact measurement of surface and distance.

This introduction is followed by a list of publications which can be classed as itineraries or road-books, and which appeared in the United Kingdom: (i) Between 1577 and 1675; (ii) between 1675 and 1798; and (iii) from 1798 to about 1850. The first of these periods has its origin in the travels through England of John Leland (1535-1543), and commences with the itineraries of Holinshed and Harrison (1577), and of William Smith (1588), and *Guide des Chemins d'Angleterre*, published by Jean Bernard, in Paris, in 1579, and is, later, illustrated by a series of books founded on John Norden's *Tables of Distances* (1625), measured by the old British mile, which was in use until the roads were perambulated by John Ogilby in the reign of Charles II. The second period of classification dates from the publication of Ogilby's *Britannia* in 1675—a work which embodies in a hundred folio sheets of road-maps the results of Ogilby's exact measurement of the principal roads of England and Wales. From that date until the end of the next century a large number of road-books is recorded, including a certain number published in Scotland and Ireland, founded both in form and details on the work of Ogilby. From 1798, the date of publication of Cary's *New Itinerary*, which was based on John Cary's measurements extending over 10,000 miles of roads in England and Wales, road-books and itineraries became more exact and more complete and artistic, illustrating a third and last period of their development.

The author refers, finally, to a few representative French road-books and maps of the roads of France which throw light on the general subject.

Sir Herbert Fordham had, however, also had his paper printed in full, and kindly offered copies to all those interested. From this complete paper we quote the following sections relating to Scotland in the three classes into which the road-books were divided:—

(1.) 1575-1675.—In Holinshed's *Chronicle*, after the roads of England already noted, is a short list of Scottish roads, seven in number, headed "Of certeine waies in Scotland, out of Reginald Wolfes his annotation," as follows: (1) "From Barwijc to Edenborow," in nine stages, 57 miles; (2) "From Edenborow to Barwijc, another waie," in six stages, 41 miles; (3) "From Edenborow to Dunbrittaine westward," in five stages, 48 miles; (4) "From Strivelin to Kinghorne eastward," in eight stages, 30 miles; (5) "From Kinghorne to Taimouth," in four stages, 31 miles; (6) "From Taimouth to Stockeford," in eleven stages, 179 miles; and (7) "From Carleill to Whiteherne westward," in five stages, 79 miles. In *The Description of Scotland . . . unto the year* 1571, *and continued to* 1585, and originally published in 1585, which occurs in vol. v. of the edition of 1808, no mention is made of the roads of Scotland.

Thomas Porter's *New Booke of Mapps*, already mentioned, while it gives an alphabetical table of names of towns for Scotland, does not contain any particulars of roads in that country.

Nothing else in the way of road-books relating to Scotland appears to have been published until the eighteenth century.

(2.) 1675-1798.—While John Ogilby confined his perambulation of roads to England and Wales, and was followed in this limitation by the books which depended on his survey—*The Traveller's Guide*, 1699, *Britannia Depicta*, 1720, etc., and Senex's reproductions of Ogilby's Road-maps, as well as the earlier issues of Ogilby and Morgan's *Traveller's Pocket-Book*—the northern roads were continued first to Edinburgh, and, later, to Glasgow and to Port Patrick, and from Edinburgh to Aberdeen and Inverness, and cross-roads were inserted for the southern parts of Scotland in English itineraries from at least as early as Rocque's *Traveller's Assistant* (1763), and the first issue of Paterson's *Roads* (1771).

One special publication occurs, however, early in the eighteenth century, dealing with the Scottish roads, which is curious, namely: a small, rough, little pamphlet of only eight leaves, printed in Edinburgh in 1711, of which the title runs—*A Description of the Most Remarkable High-Ways, and whole known Fairs and Mercats In Scotland, With Several other Remarkable Things: As also, A Description of the High-Ways from one Notable Town to another, over all England, and thereby how to Travel from any of them to the City of London. Edinburgh, Printed by John Moncur, and Sold at his Printing House at the foot of the Bull Closs*, 1711. This is the first known Scottish itinerary. Five of its little pages are given to the roads of Scotland, two to the connections with England and London.

Paterson, apparently, published his *New and Accurate Description of all the Direct and Principal Cross Roads of Scotland* concurrently with the issues of his *Roads* of Great Britain, but I have not succeeded in finding a copy earlier than one of the fifth edition, 1781. It was also issued in 1789, but, later, seems to have been amalgamated with the larger volume. In the latter the north road is continued from Berwick to Edinburgh from the first edition, which contains both an index to the roads of Scotland, and the principal direct and cross-roads of that kingdom. Paterson's *Travelling Dictionary*, which consists of distance tables, includes Scotland, and his *British Itinerary*, 1785 and 1803, includes engravings of some of the Scottish roads. Owen's *New Book of Roads* incorporates a section for the high roads, and principal cross-roads of Scotland, and Ogilby and Morgan, in their *Traveller's Pocket-Book*, already mentioned, include the roads of Scotland from at least as early as the year 1782. Bowles's *Post-Chaise Companion* (1782) contains, in respect of Scotland, only the Scottish roads as far north as Edinburgh, from Berwick, and *The Traveller's Companion*, of 1789, those to Edinburgh, Glasgow, and Port Patrick. Among French Road-books, Dutens' *Itinéraire* gives the route from Edinburgh to London, and from the fifth edition (1786) adds two roads from Belmont to Edinburgh. The itineraries and road-books exclusively devoted to the northern kingdom in the second half of the eighteenth century are not numerous. They consist in fact only of Paterson's *Scottish Roads*, already referred to, and the *Survey and Maps of the Roads of North Britain or Scotland*, engraved after the plan of Ogilby's survey of England, by a variety of artists, for the surveyors, George Taylor and Andrew Skinner, consisting of sixty-one plates, with a general map and an index, 1776, with, in the same year, a reduction of these plates, forming a duodecimo pocket volume of fifty-two pages, with a title and a general map, with the title: *The Traveller's Pocket-Book, or An Abstract of Taylor and Skinner's Survey of the Roads of Scotland*. Another reduction of the original road-book was published at Edinburgh later, apparently about 1805.

I have not noticed any other special Scottish road-books of this period.

3.) 1798-1850.—The itineraries of Cary, Paterson, and Owen, of which editions have been already noted as occurring in the nineteenth century, contain a certain number of the Scottish roads, and this is generally true of the English road-books of the period 1798-1850, such as Ogilvy's *General Itinerary* (1804), Laurie and Whittle's *New Traveller's Companion* (editions of 1828 and 1834), Mogg's *Pocket Itinerary* (1826), Gray's *Book of Roads* (1824), Smith's *New Pocket Companion* (1826 and 1827), Mogg's *Survey* (1814), the *Nouvel Itinéraire portatif* (1825, 1836, 1837), and the first edition of Leigh's *Pocket Road-Book*, which contains "Part of Scotland" (1825).

The special Scottish road-books are again not numerous. They include, in the first decade of the century, *The Gazetteer of Scotland*, Dundee, 1803, and Edinburgh 1806, 8vo (but only for a short table of a few pages of the principal roads, measured from Edinburgh); *The Scotch Itinerary containing the Roads through Scotland, on a New Plan*, by James Duncan, Glasgow, 1805, 12mo, with editions of 1808, 1816, 1820 [1821], and 1827 (in which the author explains that "the Scotch Itinerary was begun upwards of two years ago, under the conviction that there was not in print a proper list of the Roads through Scotland"), and an edition, in small octavo, "with the New Roads, etc., etc., since the survey was taken" of Taylor and Skinner's *Survey of the Roads of Scotland*. This last-mentioned work has now 178 pages of road-maps, engraved, with eight index-pages, also engraved, at the end. It is published at Edinburgh by Thos. Brown, without date, but on paper water-marked 1805. It may, therefore, be attributed to that, or an immediately subsequent, year. Some period occurs between these publications and the appearance of any original work in the nature of an itinerary of the Scottish roads. In 1821 the "Second Edition, With numerous Corrections and Additions" of *An Account of the Principal Pleasure Tours in Scotland: with a copious Itinerary of the Great Lines of Road, and the several Cross Roads in the Country*, appeared, Edinburgh, 8vo. I have no note of the earlier issue. This book is in two sections, the itinerary constituting the second. Two years later was published the *Principal Roads through Scotland, From Edinburgh, Glasgow, Etc.; Including the Usual Tours by the Forts along the Caledonian Canal, and to Loch Katrine*, also in the second edition, Edinburgh 1823, 12mo. There is also an edition of 1827 of this work. Leigh's *New Pocket Road-Book of Scotland*, a companion volume to those issued for England and Wales, and Ireland, seems to have been first published as a separate Scottish guide in 1829. There was a third edition, "considerably enlarged and improved," in 1839. *The Scottish Land Tourist's Pocket Guide*, with an appendix containing the principal roads through Scotland, editions of 1839, 16mo, and 1850, 16mo, both Glasgow, and the itinerary printed at the end of the early editions of Black's *Picturesque Tourist of Scotland*, Edinburgh, 1843, etc., 12mo, complete the list of what I have found worth formal notice in the way of Scottish road-books.

The paper was illustrated by an exhibit of road-books and itineraries, and was followed by an interesting discussion, in the course of which it was pointed out that in the early days the aim was not to facilitate but to hinder communication between England and Scotland and between the Highlands and Lowlands.

Dr. Felix Oswald followed with a paper entitled "From the Victoria Nyanza to the Kisii Highlands," of which the following is an abstract:—

From Kisumu the author sailed round the vast basaltic mass of Gwasi to

Karungu on the east coast of the Victoria Nyanza. The hundred-fathom line lies so close to this coast that the considerable depth of the lake here is probably due to a north-south zone of dislocation. For six weeks last winter he camped six miles south of Karungu, investigating some Lower Miocene deposits and collecting vertebrate fossils, etc., for the British Museum. The country consists of high grassy downs of a dissected basalt plateau, with scattered trees of candelabra euphorbias and spiny mimosas. It is separated by the broad alluvial plain of the Kuja river from the rugged granite heights of the Anglo-German frontier. Here the lecturer observed at close quarters the primitive habits and customs of the naked Kavirondo negroes, a Nilotic race of fine physique and high morality. Thence he marched eastwards up the Kuja basin, mapping the topography and geology of hitherto unsurveyed country, through districts decimated by sleeping-sickness, with a consequent reversion to a state of nature. Crossing the granite range of Gongogongo (the haunt of lions and hyænas) and the gneissic peneplain of Sakwa, he entered the Kisii Highlands by the Kuja gorge at Vinyo. This quartzite plateau (6000 to 7000 feet high) breaks off by steep escarpments to the north-west and south-west, facing the platform of gneiss and schists (with auriferous quartz) at their foot. A vast intrusion of dolerite occurs between the quartzite and the underlying schists, and yields a very fertile soil in the Kuja valley and especially near the base of the escarpments; here consequently are situated the chief settlements of the Kisii negroes, a Bantu-speaking race, differing greatly from the Kavirondo. The country has been practically deforested by their wasteful custom of clearing the ground for their crops by fire.

Kisii Boma, near the head of the Riana, is the administrative centre (transferred from Karungu), and the sleeping-sickness camp has also been removed to this healthy district, suitable for Europeans. Thence the lecturer marched north-west to the Kavirondo gulf at Homa bay, leaving the Kisii natives at the Riana river. Again crossing the dissected peneplain of gneiss (with intrusions of quartz-porphyry) he entered upon a grassy undulating plain from which conical hills of basalt rise abruptly. Between the little trading-ports of Homa and Kendu he found gypsum deposits, which probably indicate that at the time of their formation the Kavirondo gulf was isolated from the Victoria Nyanza. Denudation has been very active around the abrupt basaltic heights of Ruri and Homa, especially since the epoch when the lake stood much higher than at present. The lower contours of the surrounding mountains are rounded, whilst the upper peaks, which have never been covered by the water, are sharp and jagged. An investigation was made of the soda-lake of Simbi, which lies in an explosion-crater, and the coastal region west of Kendu was also explored.

Another African paper, also illustrated by lantern slides, and also on an African subject, was that by Mr. G. W. Grabham on "The Country North of Lake Albert." No abstract of this paper was furnished. Mr. H. M. Cadell then read a paper on "River Development in Central Scotland," with lantern views, which practically followed the lines of his lecture to the Society, published here in the May issue (p. 225).

In the afternoon Mr. A. H. Garstang gave an interesting and well-illustrated account of the Canons of the Cevennes, which, however, followed somewhat too closely the guidebook standpoint, in place of the geographical one. The following short summary may be found useful:—

The Cañon of the Tarn was almost unknown even to the French traveller until 1890, when the publication of M. Martel's *Les Causses de Languedoc*, and the

year following of *Les Cévennes*, drew attention to its majestic scenery and interesting geological characteristics. Vast areas in the Cevennes consist of plateaux or "causses" nowhere less than 2000 feet high, split up during the course of centuries into different blocks by the rivers that gather in the granite mountains of Lozere-Aveyron. On the porous surface, the vegetation is ill-nourished and stunted. While little moisture remains on the surface, the rainfall is considerable. It honeycombs its way through the limestone and collects in innumerable streams, which leap from the rock into the gorges of the rivers and their tributaries. The climate is severe—cold in cloud, shadeless in sunshine. Descend into the gorges and the change is magical, to the gracious atmosphere of a southern climate and a region of luxuriant vegetation.

The Gorge of the Tarn is 38 miles long, and up to four years ago the greater part of it had to be traversed by boat. In parts it contracts to a width of less than half a mile between rocks which exceed 1600 feet in height. The valley of the Jonte, a tributary of the Tarn, which joins it at Le Rozier is, in its proportions, little inferior to the Tarn, and in some stretches shows even more resemblance to the cañon type. At a height of 1000 feet above the Jonte, in the limestone cliff which overhangs it, is the entrance to the Grotto of Dargilan. Though it does not compare in extent with the more famous Grottoes of Han, it has the advantage in the beauty and variety of stalactites. Half a day's journey further on, in the highlands from which Mount Aigonal rises, is the abyss and cavern of Bramabian. Returning from Mount Aigonal to the Tarn Valley by the Defile of the Dourbie, on the summit of the Causse Noir, we meet the huge collection of limestone rocks called by the natives Montpellier-le-Vieux. It may be doubted whether there is a more fantastic example of the effects of atmospheric erosion on friable dolomite in existence.

On Monday morning a large audience assembled for the papers and discussion on Antarctic exploration. The first paper was read by Sir Clements Markham, and it was felt that, in his desire to do honour to Captain Scott, he dealt scant justice to other explorers.

Sir Clements said that it must be understood that their object when he began his advocacy of the renewal of Antarctic work in 1893 was the exploration of the Antarctic continental land. His action was followed by seven or eight enterprises from at least six different countries, but they were not directed to the object which he advocated. Some of them were mainly confined to the South Temperate Zone, and hardly reached even the Antarctic Circle. Others had gone a little further, and had sighted land at a distance, but all those expeditions were unconnected with the expedition to the Antarctic continental land. They achieved valuable scientific results, however. Fully appreciated, the objects of a modern Antarctic expedition should be to determine the nature and extent of the Antarctic continent, to penetrate into the interior, to ascertain the nature and depth of the ice cap, to observe the character of the underlying rocks and the fossils, to take magnetic and meteorological observations both at sea and on land, to observe the temperature of the ocean at all depths, to take pendulum observations, and to sound, trawl, and dredge. Sir Clements Markham then proceeded to describe the steps leading to the despatch of the *Discovery*, and said that there was no place where such a wooden ship could be built but in the

city of Dundee. Captain Scott's discoveries were many. The existence of the most extensive mass of ice in the world had been assumed, but it was discovered by Captain Scott, when he reached it with two men after ascending the Ferrar Glacier. He faced appalling hardships and difficulties with his two companions in advancing on the ice cap for 160 miles at the least. One of the results of that very remarkable journey was the series of magnetic observations which, combined with those at the winter quarters, fixed the position of the magnetic pole. Captain Scott was the founder and originator of Antarctic sledge travelling, which differed in several respects from Arctic travelling. A most interesting discovery was that the Antarctic land ice was receding and not advancing. The results of that expedition were indeed magnificent, but the work could not be completed in that section of the Antarctic regions even in two seasons. Captain Scott therefore organised a final expedition—final as regards that section of the Antarctic continent. When the *Terra Nova* left England she conveyed to the Antarctic the best equipped expedition for scientific research that ever entered the Polar regions.

They could not yet really take stock of the results, for they were but half completed, but they knew the commander and his able staff. They had his first report, and they could make a forecast to some extent of what his second would be. The first great success of the expedition was the discovery of fossils which would establish the geological position of the Beacon sandstone. Every detail of Captain Scott's journey to the South Pole had been thought out with characteristic thoroughness, and the attainment of his object was, humanly speaking, certain. Captain Scott would have reached the South Pole on about January 14. His return in safety had been amply provided for by the depôts, and at this time he and his gallant companions were enduring the rigour of an Antarctic winter and preparing their next great service to geography. He would have taken magnetic observations from the winter quarters to the South Pole—the only practical reason for going there. He had reason to believe that the intention of Captain Scott was to proceed along the coast as far as possible to the south in the next season, thus solving the problem of the Great Ice Barrier. One important result of Captain Scott's persistent determination to complete the work of exploration in the Victoria Quadrant would be that there would be a complete series of meteorological, magnetic, and tidal observations for four years. Captain Scott and five of his companions would have passed through four Antarctic winters, and they had devoted their energies to geographical discovery during four Antarctic travelling seasons. Scott's two expeditions formed the two most important and the most fruitful enterprises that had ever been undertaken, either in Arctic or in Antarctic regions. Assuming the complete success of all the three expeditions which were now wintering in the Antarctic regions, there was still much remaining for future explorers to achieve. The discovery and examination of the Edwardian coast from Cape Colbeck to the meridian of Graham Land comprised in the Ross Quadrant was the next most important work to be undertaken. It would be a difficult

and a more than ordinarily perilous enterprise, but with a well-thought-out plan it was quite feasible. Next there were the operations for ascertaining the depth of the ice cap at several distant points, which had not yet been attempted. There was plenty of Antarctic work remaining to be done for many years to come. Meanwhile they must look forward to next spring, when the whole country would welcome the return of Captain Scott, the greatest of all Polar explorers, and hear of the geographical achievements of himself and his gallant companions with the deepest interest and with well-founded national pride.

Sir Clements was followed by Dr. W. S. Bruce, whose subject was "The Antarctic Continent." He said that from the earliest times in the history of geography there had always been the theory of a *terra australis incognita*. To Peru, at the end of the sixteenth century, belonged the credit of sending out the first expedition in search of that continental land supposed to lie round about the South Pole. Captain Cook, from 1771 to 1775, however, was the first to determine that if an Antarctic Continent existed, it must lie almost wholly within the Antarctic Circle, and Sir James C. Ross and Lieutenant Wilkes were the first to map out extensive parts of the coastline. Palmer, Johnson, and Morrell, Biscoe, Ross, d'Urville, and others had also discovered other parts of the Continent to the south of South America, while the discoveries of Biscoe and of the *Scotia* had helped to link up those lands with those of Wilkes and Ross and to verify Wilkes's nomenclature "The Antarctic Continent" and Sir John Murray's name "Antarctica." While Ross was the discoverer of the extensive mountain range of Victoria Land, Armitage by his pioneer journey was the first to discover and travel upon the high plateau of Antarctica, which Scott, the following year, proved extended far to the west of the coastal range. Scott and Royds had shown that the Ross Barrier extended at least 300 miles to the south and south-east, and Shackleton that it abruptly ended in about 84° S., and that the Victoria Land range trended across his path to the south-east. Shackleton had ascended this range and discovered the South Polar plateau at an elevation of about 10,000 feet, and travelled over it to within 100 miles of the Pole, proving that the South Pole was situated on the plateau. Amundsen had confirmed that by his extended journey to the Pole itself. Amundsen had further traced the Victoria Land range to the south-east as far as 80° W. and 88° S. In 81° S. and about 165° W. he had seen "an appearance of land," which, with the northerly range and the extension of the Victoria Land range, definitely determined that the Ross Barrier did not extend further south than 85° S. or further east than 165°, and obliterated the suggestion that this barrier ran across Antarctica, dividing it into two land masses—a theory that was condemned by the discoveries of the *Scotia*, and which he had shown was impossible, at least as far as the Weddell Sea was concerned.[1]

[1] "Bathymetrical Survey of the South Atlantic Ocean and Weddell Sea." By W. S. Bruce. *Scot. Geog. Mag.*, August 1905.

*Über die Fortsetzung des Antarktischen Festlandes zwischen Enderbyland, Coatsland und Grahamland sowie das Vorhandensein von Neu Südgrönland.* Von Dr. William S. Bruce. Basel: 7 September 1910 (Scot. Ocean. Lab. Publications, 1910).

The *Scotia* had made extensive researches, mapping the coastline of Antarctica, where many fathoms of water were supposed to exist, and thus adding to the area of Antarctica about half a million square miles. The *Scotia* had proved that where Ross thought he had 4000 fathoms, only 2660 fathoms existed; and had demonstrated, especially meteorologically, the probability of the existence of New South Greenland. It had also shown the existence of a "rise" stretching 1000 miles south in extension of this mid-Atlantic "rise," and called the Scotia Rise. This "rise" appeared to connect up with a "rise" between Bouvet Island and the Sandwich group, which islands were again connected by rises, joining them up through South Georgia with South America, and through the South Orkneys with Graham Land. He believed this series of rises indicated former continental connections between South America and Africa with Antarctica. Thus the one land mass theory was supported by the modern researches of the *Scotia*, as well as by the far south and eastern explorations of Shackleton and Amundsen. The Antarctic continent had an area equal to that of about Australia and Europe combined. Bathymetrically the *Scotia* practically proved former land connections between South America, the mid-Atlantic Rise, and Africa, and the researches of Mawson were likely at the present time to prove former Australian and New Zealand connections from the bathymetrical point of view. These connections had been long upheld by naturalists, notably Hooker in 1845, Rutimeyer in 1867, Huxley in 1868, and Forbes in 1893, whose striking map was well worthy of attention. Hedley, Benham, Chilton, Osborn, Scharff, and many others also wrote with a flood of biological evidence in support of part land connections of Antarctica with New Zealand, of Australia with South America, of Australia with South Africa, and of South Africa with South America; while Pirie's discovery of graptolites in the South Orkneys proved a greater extension of Antarctic lands in Silurian times.

An animated discussion followed, in which Dr. Rudmose Brown, Dr. Marshall, Mr. T. V. Hodgson, and Professor Chilton, all associated with Antarctic work, took part. While all the speakers generously acknowledged the value of Captain Scott's work, they strongly deprecated the exalting of one living explorer at the expense of others.

Mr. Edward Martin read a paper on "Dew and Mist Ponds," of which the following is an abstract:—

The author in this paper gave an account of some experiments which he made on the Sussex Downs in order to test the truth of the theory that the so-called dew-ponds of the south of England are kept full, or partly so, by dew. A dew-pond is a pond, generally on the chalk downs, which has no visible means of replenishment other than rain, and as such ponds as a rule maintain a supply of water during a long spell of hot weather, when most of the ponds at lower levels have dried up, the conclusion has been drawn that they have been fed by dew, and that this dew has been sufficient to prevent them being dried up. The name is quite modern, and even Gilbert White, who wrote about their peculiarity, does not call them by that name. It is probable that in the popular mind any form of condensation out of the atmosphere has been regarded as dew, and that really these ponds are "mist-ponds." As regards the foundations of such ponds there is no uniformity. The author found no fewer than ten different

arrangements of the bottoms of the ponds. Many of them had straw as part of the foundations, but no practical pond-builder contended that this had anything to do with the condensation of dew into the pond. Straw is a bad foundation on which to puddle clay or chalk, and must necessarily become damp in the process, and so become a fair conductor of heat. In order to test the theory that straw would prevent the heat of the earth from rising and warming the pond after nightfall, two ponds were made, in one of which the puddle was laid direct on the straw, and in the other planks were inserted between the straw and the puddle in order to give a firm base. Experiment went to show that in neither case was there any appreciable effect as regards dew-deposition. This was probably so because, as pointed out by Dr. J. Aitken, such a foundation would tend to make the water take a higher temperature during the day, and this would be in direct proportion as the bad heat connection was effective during the night. The water would not have sufficient time as a rule during the short summer night to become reduced below dew-point.

The experiments made only refer to those ponds which have no trees or bushes growing around them which would prevent free radiation. It is not denied that there would be considerable drip from trees, etc., which would feed a pond, but this means of replenishment would be of a different nature from that which, it has been supposed, a pond would receive when the grass of downland around was seen to be drenched with dew. There may be heavy dews upon the grass, but there may be none whatever deposited in the pond. It has been suggested that there may be upward percolation of water from the soil into the pond in dry weather, and the state of the puddle when the pond was dug up seemed to show that to some extent this may be the case. On the other hand, there may have been escape of the water downward, for it is probably impossible to make a pond bottom completely watertight. It is found that if precipitation and evaporation were equally spread over the year, a pond which was well laid would never dry up. But nine-tenths of the annual evaporation takes place in the summer six months, whereas rain is irregular in its distribution. The evaporation would actually empty some ponds in the summer months if there were not some other form of condensation which assisted in overcoming the concentration of evaporation during the droughts. The author sees in fogs and mists the factor which tends to keep alive the best-made of the ponds. The precipitation of mist into ponds, aided perhaps by silent discharges of electricity, and the entanglement of mist-laden salt-dust in the hollows in which the ponds lie, are believed to be the means by which some ponds maintain a supply of water all through the year, in spite of the great draught which is made upon them by numerous cattle.

Mr. P. Amaury Talbot then gave an account of "Some Experiences in Southern Nigeria," as follows:—

Southern Nigeria is divided by the great river running north to south, while transversely it is clearly separated into three belts:—

1. The region of lagoons and creeks, of which the Niger delta itself forms half, and which stretches, like some colossal Venetian littoral, along the whole seaboard, so honeycombed with waterways that it is possible to pass from French Dahomey to the German Cameroons without so much as sighting the sea. This region is a refuge for natives of the lowest type. Its vegetation consists mostly of mangrove and that usual to fresh-water swamps.

2. The forest belt, dense save where the size of the population has necessitated extensive clearings. From a geographical point of view this region is by far

the most interesting, whether as regards the formation of the land itself, its flora and fauna, or the origin, character, and customs of its peoples.

3. The northern stretch of open grass-land, approximating both in physical features and inhabitants to those of Northern Nigeria.

It is principally with the middle region that I propose to deal, and, since the land of the Yorubas to the west, and that of the Ibos in the centre, is comparatively well known, I would venture to draw attention more particularly to the eastern part, of which the Cross River is the principal waterway. Its main tributaries flowing northward are divided by the watershed of the Oban Hills from those of the southward-tending Calabar, Kwa, and Akwa Yafe rivers. A little below the fifth degree of latitude comes a line of waterfalls, where the three last-named rivers break from the granite and gneiss regions above, to the flat country of sedimentary deposits.

Near the falls of the Akwa Yafe occurs a remarkable system of underground caves, through which flow two subterranean rivers. To the north stretch the outlying spurs of the Cameroons, the line of which is broken here and there by an occasional pass.

The flora and fauna of the country are remarkably rich.

Its principal inhabitants are :—

*Ododop*, or *Korawp*, of typical forest-negro type, who have come over from the Cameroons. Each member of the tribe possesses a "bush" soul, usually buffalo, antelope, or wild boar.

*Ojo* and *Uyanga*, who have trekked from the north in quite recent times and whose ritual still demands human sacrifice.

*Ekoi*, a semi-Bantu people, of high type, with extraordinary interesting folk-lore and customs.

All these peoples show plainly the influence of the deep "bush" amid which they dwell, both in character and beliefs. Magic is the dominant note of their lives. Ancestor-worship, Nature jujus, secret societies, and ceremonies for ensuring protection against witchcraft, blend together in one complicated ritual. Yet traces still remain to show that these forest folk once lived in open country, bounded by wide horizons, like the present-day dwellers in the northern grass-lands.

A paper on the "Submarine Cañon of the Hudson River," by Dr. J. W. Spencer, was postponed till Tuesday morning. The subject-matter of this paper is discussed in Dr. Hull's *Monograph on the Sub-Oceanic Physiography of the North Atlantic Ocean*, to which Dr. Spencer contributes a chapter. This monograph, of which a review appears this month, can be consulted in the Society's Rooms, so that an account of the paper is not necessary.

Among other papers read was one on "Exploration in the Sonoran Desert of Mexico," by Mr. I. N. Dracopoli, who said :—

The Sonora Desert is that part of Mexico which is bounded on the north by the International boundary-line, on the west by the Colorada River, on the east by the 111th meridian of west longitude, and which extends south to the head of the Gulf of California and along its coast as far as the 29th parallel of latitude. This large tract of country is singularly little known, though it contains much that is of great interest, both scientifically and commercially. Rising in the north-east to a height of 2000 to 3000 feet and more in Southern Arizona, the country slopes gradually and, to the traveller, imperceptibly towards the south-west till the coast

is reached; and this great plain is characterised by a series of isolated mountain ranges, rising abruptly to an average height of 4000 feet and more, and from five to thirty miles in length. They usually run in the same general direction south-east to north-west, thus dividing the country roughly into a series of broad and sandy valleys. The mountains, whose geological formation is chiefly volcanic and granite, are rugged in the extreme, with little vegetation as a rule, save cacti, but are highly mineralised, and traces of gold and copper are common in many parts. Round and to the north-west of Adair Bay is a broad belt of sand-dunes, at some points twenty miles in breadth, and the flora and some of the animals found therein are very local in character and are not seen elsewhere. The valleys contain in abundance trees, of which the most common are mesquite (*Prosopis velutina*) and paloverde (*Parkinsonia torreyana*) shrubs and cacti. The appearance of the country is deceptive and would lead one to suppose that there was water in abundance, but the contrary is the case. Water is never plentiful, and in the majority of cases is non-existent, though there are indications that point to an abundant underground flow. The annual precipitation is about three inches, which falls during the months of July and August, at which time also the heat is greatest. As in all dry countries where evaporation is rapid, the daily range of temperature is very great, there being often a difference of from 40° to 50° F. between the maximum and minimum; 120° in the shade is not at all uncommon in the daytime.

The flora of this region has been wonderfully endowed by Nature with means for obtaining and storing water, and the study of it therefore cannot fail to interest the traveller. The country is remarkable for the great number and variety of its cacti, which form the main source of food for the wild animals and also for the Indians. The latter value them very highly, and once each spring hold a festival in their honour before setting out to gather their fruit.

Southern Arizona and Northern Sonora are inhabited by the Papago Indians. They are a semi-nomadic tribe of Piman stock, and physically are a fine race. Being of a peaceful disposition they have not been much molested, but the coming of civilisation in the last twenty years has not proved an unmixed blessing, for it has brought to them, as to the Yuma Indians, the scourge of consumption and other terrible diseases unknown to them before. They have adopted the clothing of the Mexicans, but otherwise they remain little affected by the coming of the white man, and they still cling tenaciously for the most part to their religion and its many interesting customs. There are many traces of ancient civilisation in the Papago country, and other indications which tend to show that the Indians are not indigenous to the country.

In the south-west of the Sonora Desert, in the mountains that fringe the coast, and in the island of Tiburon live the Seri Indians. They form a separate family in themselves, and are quite distinct in religion, language, and customs from all other North-American tribes. Agriculture is unknown to them, and they live a more or less nomadic life, building flimsy brush-shelters as they go along. They depend for their food on hunting and fishing, and various forms of wild fruits, berries, and roots. From the local character of their gods and other evidence, it is probable that they have lived in this country for countless generations and are, unlike the Papago, autochthonous.

Mr. Dracopoli was followed by Mr. W. J. Harding King, who, in describing the Libyan Desert and Ennedi, said:—

The Libyan Desert may be taken as stretching from the Nile to the Tibesti

mountains, and from the fertile belt on the Mediterranean coast to the boundary of the Sudan vegetation. The map of this district is based mainly upon a few travellers' routes, and the surveys of the Egyptian Government in the Egyptian oases: the remainder of it depends almost entirely upon information derived from natives.

The north-eastern portion of the desert is best known. It consists of a high barren plateau, below which, in large depressions, lie the chief oases. These have been inhabited from very early times. They are irrigated by primitive artesian wells, which are supposed to date from Roman times. They are very fertile, and produce magnificent dates, besides other fruits and a few cereals. The natives on the whole are a feeble race, probably owing to the prevalence of fever. In many places the sand-dunes are encroaching on the cultivation. The effect of sand erosion on the plateau is very marked; sand-dunes cover large areas in the northern part of the desert. The dunes run in parallel belts, and are either longitudinal dunes or crescentic in shape. The belts run north and south, converging slightly towards the north.

It was formerly supposed that the greater part of the Libyan Desert was covered with sand, but this was found not to be the case. A large plateau, starting about twenty miles south-west from Dakhleh oasis, and running west, banks up practically the whole of the dunes. South of the plateau is a large sandy plain, rising towards the south. The top of a hill in this plain was found to be 2150 feet above sea-level.

South of lat. 20° N. a number of fertile spots are reported to exist. West of Kowora the desert is said to be all rock, intersected by fertile valleys. The water collects in pools on the rocks during the rains. West of Ennedi is a basin, into which the rainfall from the surrounding country drains, forming swamps or pools in the rains, which to a great extent evaporate in the dry weather. Ennedi is reported to be full of Roman remains. In Ershay lake there are said to be crocodiles. The rock desert ends one day east of Kowora. Further east the country is said to be flat and sandy.

The valley of the Bedayat is reported to contain many springs, which overflow into pools. The Arabs say the rainfall from the east and north sides of the Tibesti range discharges into an old river-bed,—the Wady-el-Fardy—which supplies the oasis of Kufa with water and then runs past Farabub, Siwa, and Bahrein to the Nile. Another old watercourse—the Wady Howar—is said to receive the wadys that flow north from the Sudan and to run into the Nile valley near Dongola.

Professor J. L. Myres then read a paper on "Some Effects of Climatic Pulsation in a Highland Region." The paper suggested a corollary resulting from Dr. Ellsworth Huntingdon's work on climatic pulsation in Central Asia and Palestine. The same circumstances which favour human habitation of the great grasslands of the west—namely, increased and more generally distributed rainfall—tend to produce an opposite effect in highland regions by restricting the area of corn cultivation and increasing the difficulty of getting in the hay crop. Where there is excessive precipitation the highland population is forced to move downward into adjacent lowlands and to take up wholly or in part a predatory mode of life. Examples were given of such movements originating in the highlands of Central and South-Eastern Europe which appeared to be due to the causes suggested.

Mr. T. S. Muir followed with the paper on "Geographical Education in Scottish Schools" which appeared in our last issue. The paper aroused a considerable amount of interest, and as a result a committee was formed "to inquire into and report upon the present position of geographical education in Scotland." The field of investigation is a wide one, but one of the principal objects will be to gain accurate information as to the total or partial disappearance of geography as a higher subject in schools owing to the recently-issued regulations of the Scottish Education Department, and to the effect of this disappearance upon the supply of students of geography in the Universities of Edinburgh and Glasgow. The members of the committee were drawn from Section E, and are as follows:—Dr. Horne, F.R.S., Chairman; Dr. R. N. Rudmose Brown, Dr. W. S. Bruce, Mr. H. M. Cadell, Mr. G. G. Chisholm, Mr. J. Cossar, Professor H. N. Dickson, Professor P. Geddes, Dr. A. J. Herbertson, Dr. D. Scott Keltie, Mr. J. M'Farlane, Mr. J. Malloch, Dr. Marion Newbigin, Dr. F. Grant Ogilvie, and Mr. T. S. Muir, Royal High School, Edinburgh, Secretary.

Sir William Willcocks then read a paper on "Irrigated Canada," which was of a racy and entertaining character, but did not contain any facts of special interest.

As the above account shows the Proceedings of the Section were not devoid of value, and some stimulating discussions took place. At the same time there were certain defects in the programme which might well engage the attention of the officers. It seems clear that it is time that some more definite decision is come to as to what constitutes geography. Broadly speaking, it may be said that the British Association has two objects in its sectional meetings—to permit specialists to exchange views and give the results of their work, and to offer the general public an opportunity of learning the kind of contributions which specialists in each branch are making to the common fund of knowledge, and the line along which the individual subjects are developing at the present time. Not all sections, of course, succeed in carrying out these objects with any degree of completeness, but if we take, for example, the Natural Science Sections, it is obvious that the officers have a fairly definite idea as to what may reasonably be regarded as coming within their scope. Again, though every now and again papers err in the direction of over-technicality, yet, on the other hand, the most "popular" of the papers assume an elementary acquaintance with the terminology of the science concerned. In other words, the audience is assumed to consist first of specialists, and second of non-specialists whose interest in the subject is not confined to the British Association week.

If we turn to geography we find that the sectional Proceedings in recent years suggest, first, the prevalence of the belief that almost any subject may be regarded as geographical, though there is a distinct tendency to think that generalised descriptions of unknown or little known regions are specially geographical. But as regards this position, we have only to consider what would be the result if, in the Botanical and Zoological Sections, the most relevant papers were conceived

to be those describing new species of plants or animals, and further that it was supposed that any one could describe a new species. Again, many of the speakers in Section E tacitly assumed that trained geographers do not exist, and that they were necessarily addressing an audience with no permanent interest in the subject, and no knowledge, even elementary, of its first principles. Finally, relatively few of the papers could be said to be adapted to give the non-specialist any idea of the direction which the thoughts of active geographers are taking at the present time, or even to suggest that there is a specially geographical point of view. In our opinion, if Section E is to justify its continued existence, geographers must make up their minds to attend its meetings in sufficient force to impose their own point of view, and to stamp out the idea that the Section is the happy hunting-ground of the collector of interesting but unrelated facts, in a word—of the untrained and unspecialised observer.

The meeting, considered as a whole, was an unqualified success, the numbers reaching the large total of 2504, while gratitude was expressed on all sides for the hospitality, public and private, offered to the members, and for the excellence of the arrangements made for their comfort.

The next meeting is to be held at Birmingham, and will open on September 10, 1913.

## THE SAND HILLS REGION OF NEBRASKA.

In the September issue (p. 449) we published Dr. D. T. MacDougal's paper on North American Deserts. In connection with the same subject it is interesting to note a paper by Prof. Raymond Pool in the *Popular Science Monthly* for March last, which gives a detailed account of a special part of the North American Desert, that known as the Sand Hills Region of Nebraska.

The Sand Hills of Nebraska occupy an area of over 18,000 square miles in the north-west region of the State, between the rivers Platte and Niobrara. They are drained by the Loup river, and form a mass of rounded or conical hills, separated by depressions, many of which assume the character of valleys. The larger valleys may be a mile in width and several miles in length, and tend to run parallel to one another, being separated by steep hills which make inter-communication difficult. In addition to these well-developed valleys there are numerous hollows, which sometimes form mere pockets a few hundred yards across.

The soil on the hills is a straw-coloured sand, consisting largely of quartz, and is poor in soluble plant food. On the other hand, in the valleys there may be a large admixture of humus, and the soil sometimes becomes very fertile. Owing to the porous nature of the sand, water disappears with great rapidity after rain, and it is only rarely that streams or lakes show any perceptible augmentation even after heavy

rain. At the same time, owing to the presence of impermeable clays and rocks beneath the sand, the soil may remain quite moist a few inches below the surface, and where these impermeable beds crop out swampy valleys and lakes occur. The annual precipitation is not very small, varying from twenty-three inches in the east to about fifteen in the west. April, May and June are the wettest months, and the dry season frequently lasts from August to March. The combination of a high summer temperature with drought, the force of the wind, and the severity of the winter climate, together with the dry surface soil, make conditions very unfavourable to plant life.

Despite these conditions, however, plants do occur, the species, though not the individuals, being numerous. Over the hills the characteristic vegetation is bunch-grass, which owes its name to the tufted manner of growth, a close turf not being formed. The dominant species is the blue-stem (*Andropogon scoparius*), but other species, such as sand-grass (*Calamovilfa longifolia*) and needle-grass (*Stipa comata*), also occur. The tufted manner of growth makes the plants efficient sand-binders, and it is only they which can fix the sand sufficiently to permit of other vegetation finding a foothold. Mingled with the grasses is a yucca (*Y. glauca*), called dagger-weed from its spines. The presence of isolated clumps of this plant produces a curious effect on the hills, for cattle avoid it on account of the spines, and their trails over the dunes zig-zag in consequence. As the trails are worn into the sand they form a network with the dagger-weed in the meshes. On steep slopes the effect is to give rise to what are known as "cat-steps."

Like the blue-stem the yucca has little value as a forage plant, but in an extremity cattle will eat the flower panicle and the young fruits. Mingled with the bunch-grasses and dagger-weed are a number of other grasses, and also various brightly coloured flowering plants and some shrubs, notably Prunus, Ceanothus, Rhus, etc.

If the bunch-grass is destroyed by fire or by excessive grazing the wind attacks the exposed sand and excavates large cavities or "blow-outs." These have a crater form, and as they develop wind eddies are formed, to which the name of sand-mill is given. By means of these eddies sand is loosened from the walls of the crater and slips to the bottom. Here it is again caught by the wind and whirled out of the depression altogether, so that by a continuation of the process the "blow-out" continually increases in size. Sooner or later, however, there comes a time when the hole is too deep for the wind to reach the sand at the bottom. When this happens Redfield's-grass (*Redfieldia flexuosa*) establishes itself, and binds the loose sand by means of its slender root-stocks. For several years it may be the only inhabitant of the blow-out, but gradually other species insinuate themselves over the rim of the crater and spread downwards. So soon as the conditions are sufficiently favourable the bunch-grass makes its appearance, and gradually eliminates Redfield's-grass. Soon the ordinary bunch-grass association is completely established, and the blow-out is only represented by a hollow.

In the valleys the vegetation is of quite a different character. The valleys fall into two types, those in which standing water is not

present, and those where the impermeable beds are so near the surface that the soil is marshy. In the former, or dry valleys, the grass forms a complete turf, buffalo-grass (*Bulbilis dactyloides*) and grama-grass (*Bouteloua oligostachya*) being present in considerable quantity and forming good hay. The soil is often fertile and certain agricultural crops can be grown if precautions are taken to prevent the exposed soil from blowing. In the wet valleys, rushes, bulrushes and ferns grow abundantly, and fresh or alkaline lakes are frequent. Indeed, the existing wet meadows show signs of having been derived from lakes, the bulrush playing an important part in this transformation. This plant has creeping root-stocks like Redfield's grass, and is able to creep out into deeper and deeper water, where it catches silt among its stems, and builds up a bottom along which the other plants can spread till the water finally disappears.

As is to be expected from the above description, the region is predominantly a cattle-raising district. Thousands of cattle are annually shipped to eastern markets, and the animals thrive remarkably well on what seems very meagre forage. In winter they have to be kept on hay, chiefly the natural hay of the valleys. Attempts are, however, being made to grow alfalfa, which, once established, is found to resist the wind well. With irrigation, practicable along the Loup river, vegetables could be grown, at any rate for home use.

Attempts are now being made to afforest the region with jack-pines, and a fair measure of success has so far attended these efforts, a young plantation, dating from 1903, now showing trees of twelve feet in height and four inches in diameter.

The population is scanty, as may be gathered from the statement that the homesteads provided for settlers extend to 160 acres. The life is hard, the absence of fuel and building material telling especially against those with little capital. The characteristic house is built of sods and roofed with the same material, though board houses are now being built, and even more elaborate dwellings of cement blocks. Lynch law still prevails, and, as in other parts of the west, horse-stealing is the unpardonable crime.

Whatever development agriculture may attain in the valleys, it seems likely that as a whole the region is destined to remain a pastoral area.

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## GEOGRAPHICAL NOTES.

### Europe.

**Site of the Battle of Sauchieburn.**—Mr. John E. Shearer has recently made some investigations in regard to the site of the battle known in history as the Battle of Sauchieburn, and has communicated his results to us. The battle, it will be remembered, took place in 1488, and was followed by the murder of James III., who is said to have been killed in cold blood at Milton Mill.

The statement that the fight took place at Sauchieburn, dates only from 1777, when the Rev. William Nimmo published his history of Stirlingshire, in which he states that the armies met on a tract of ground called Little Canglar, upon the east side of Sauchie burn. In Raphael Holinshed's *Chronicle* of 1577, it is stated that the king joined battle with his adversaries "at Bannocksburne, within two miles of Stirling," and this seems more reasonable when it is borne in mind that the army advancing against the king's forces had come from Edinburgh, and it is confirmed by the statements made by other early historians. Thus Bishop Leslie of Ross, in his *History of Scotland* in 1578, says, "the King was slane at the Mill of Bannockburne, near that place." Apparently Nimmo's mistake arose from the fact that the Bannockburn Mill had disappeared in his day, and he assumed that the mill at Milton must have been the mill alluded to, and altered the site of the battle to correspond.

**The Pastoral Life in the Tarentaise.**—We have summarised here on various occasions the results of researches on the conditions of existence in the high Swiss valleys. M. Ph. Arbos has recently conducted an investigation of similar type in the Tarentaise, the name given to the upper valley of the Isère, in the French Alps. His results are contained in a long article published in the *Annales de Géographie* for July 15, and as they afford some interesting contrasts to the conditions prevailing in Switzerland, a short summary of the article may be of interest.

Though the name of Tarentaise is applied to the valley as far as Albertville, yet it only takes on the characters of a mountain region above Moutiers, a small town known to travellers as the place where the railway is reached after the descent from the Little St. Bernard Pass. Between Moutiers and the source the valley of the Isère falls into three different regions from the point of view of topography. The highest section includes the two villages of Tignes and Val d'Isère. Here the valley is excavated in calcareous rocks of Triassic age, and has very steep slopes, bare above and clothed with pines below. Owing to the elevation the winters are excessively cold. This region extends down to Sainte Foy, beyond which the valley is open, with gentle slopes, and the floor is covered with alluvial deposits. The climate in summer is warm and dry, and the vine, before the advent of phylloxera, prospered as far up as Bourg St. Maurice, at the foot of the Little St. Bernard. This region extends as far as Aime. Beyond this little town the form of the valley again undergoes a change with the passage of the river into another region of calcareous rocks. Here there is a succession of gorges and little basins, and the relief resembles that of the upper valley, but at the same time the summers remain warm and dry. One consequence of the peculiar form of the valley is that, till recently, communication from Moutiers down the main valley of the river was difficult, while the lateral passes of the middle region have always been comparatively easy, but communicated only with regions of generally similar character and products. The Tarentaise, till the advent of road and railway, thus

remained a region apart, sufficing to itself. The difficulties of communication with less elevated regions led the inhabitants in the earlier days to attempt to grow such plants as wheat and the vine up to the extreme limit at which they could be made to thrive. With recent improvements in means of communication the need for this is passing away, and the inhabitants are more and more concentrating upon the pastoral industry, and especially upon the rearing of cattle. No customs barrier prevents them from availing themselves of the wheat and wine of Provence, and the increased demand for the cattle of the mountain gives them the means of purchasing such products. The result is that we find a very curious transitional condition at the present time. The cultivation of the vine is disappearing. The American stocks, introduced after the ravages of phylloxera had destroyed most of the vineyards, demand continuous care, and the migrations necessary for the pastoral life, together with the reduction of the population by emigration, make it impossible to find labour to give this care. Again, no longer menaced by the fear of starvation if the stock of grain should give out in winter, as in the old days when communication with the outer world was difficult, the peasants are reducing the amount of land given to wheat, barley, oats, etc., and instead are growing fodder plants, notably lucerne, clovers, and sainfoin. This enables them to feed their beasts during winter, which formerly used to be a matter of great difficulty, for the alps in summer would maintain more cattle than the stored hay would feed in winter. Again, formerly, as in the Swiss Alps, the product of the high pasturages was Gruyère cheese, which is easily made, demanding only simple forms of apparatus which can be readily transported, and can itself be readily carried from the mountain pastures to the low ground. The making of cheese is of course still carried on, but the peasants are more and more concentrating on cattle-rearing, and export a considerable number of live animals every year. Again, formerly each household possessed a few sheep, whose wool supplied the necessary clothing. The sheep remain, but they are now raised for export. They feed, generally without supervision, on the steep slopes which the cattle cannot reach, and breed twice a year. The January lambs, born in the valley, are sold direct to the butcher; the autumn ones are strong enough to travel to the high pastures in the following summer, and improve so markedly during its course that they can be sold in autumn at a good price. As the value of the pasturage put at their disposal is insignificant, the industry is an exceedingly profitable one.

The arrangements for the migration of cattle and human beings to and from the high pastures agree generally with those prevailing in Switzerland, with certain differences in detail. As in Switzerland, the cattle of a number of peasants are committed to the care of a group of individuals, who make the cheese on the pasture, the product being divided at the end of the season, according to the number of each man's cows, and their average yield of milk. In some cases the pastures belong to the commune, and the arrangements are made in common, no man being allowed to send to the high pastures more animals than he can keep in winter from the produce of his own land. The majority of

the pastures, however, are the property of private individuals or are rented by them. These individuals also act as contractors, collecting on their pastures a stock of cattle which are partly their own, partly the property of others, obtained under various arrangements. Thus there has always been combination in summer among the members of the different communities, and this has an important bearing on the cheese-making. The fact that the cattle of many scattered proprietors are then grouped together has always given all the advantages of co-operation. On the other hand, in winter in the old days, there was no co operation, and the yield of each man's cows was too small and precarious to render it possible to make Gruyère then. What milk the badly-fed animals yielded, therefore, was used to make butter and skim-milk cheese. The latter was used in the household, while the Gruyère made in summer was sold, as far as possible. To some extent these conditions still persist, but co-operative cheese factories are being started with the object of collecting the milk in winter for the making of Gruyère then also.

In addition to the above facts, the paper contains details as to the migrations performed by the peasants to and from the high pastures, and as to their dwellings, but as these show a general resemblance to Swiss conditions they need not be detailed here.

**Origin of the Bottom-water of the Atlantic.**—One of the results of modern oceanographic investigation has been the demonstration that the water of the oceans is stratified into layers, characterised by particular temperatures and salinities, and separated from one another by discontinuity layers ("Sprungschichten"). In the *Internationale Revue des gesamten Hydrobiologie u. Hydrographie*, Dr. Nansen discusses the origin of this bottom-water, with special reference to the North Atlantic. He finds that here the bottom-water has a salinity of about 34·90 per thousand, and a temperature of about 2·4° C. (36·3° F.). Like the bottom-water of the oceans generally, he believes that this is formed at the surface by cooling in winter, the cooling starting a vertical circulation, with convection currents, which may reach considerable depths. He does not accept Pettersson's view that ice-melting is an important factor in producing the bottom-water, but believes that it is formed at the surface in a limited area to the south-east of Greenland, and also originates to some extent from water flowing out of the Norwegian Sea, across the Ridge which extends from the Faroes past Iceland to Greenland. In the Rockhall Channel bottom-water occurs with a high salinity and a comparatively high temperature, and this originates from the intermediate water of the Mediterranean Sea which passes out through the Straits of Gibraltar.

**Aurignacian Paintings in England.**—It is announced that Professors Breuil and Sollas have discovered on the walls of Bacon's Hole, near the Mumbles, Swansea, wall paintings which they believe to belong to the period called Aurignacian by French anthropologists. This period is the oldest of the three—Aurignacian, Solutrian, and

Magdalenian—into which the Upper Palæolithic era is divided, and cave paintings belonging to it are well known on the Continent, but have not hitherto been described here. In 1823, however, Dean Buckland discovered in Paviland Hole at Gower, South Wales, specimens which included the imperfect skeleton of a man, often spoken of as the "Red Lady" of Paviland, associated with implements of flint and ivory. Professor Sollas tentatively assigned this find to the Aurignacian period, especially because the bones are coloured with red ochre, a custom known to have prevailed at the period, and the associated implements, carved out of mammoth ivory, resemble others of known Aurignacian age from the Continent. During a recent visit to this country Professor Breuil examined the Paviland finds contained both in the Oxford Museum and also in the Swansea Museum, together with the cave itself, and confirmed Professor Sollas's suggestion as to their age. An examination of the South Wales caves was then made in the hope of finding paintings. None were found in Paviland Hole, nor in several other caves examined, but in Bacon's Hole, which was visited last, Professor Breuil pointed out ten horizontal bands, vivid red in colour, arranged in a vertical series about one yard in height. A deposit of stalagmite has formed over the bands and sealed them up so that the paint cannot be removed by rubbing. Similar bands have been described on the walls of Font de Gaume, Dordogne, and are ascribed to the Aurignacian period. It is expected that other discoveries will probably be made now that it is known that paintings occur in English caves. The above information is taken from an article describing the find which appeared in the *Times*.

## Polar.

**Australasian Antarctic Expedition.**—The *Aurora*, the ship of Dr. Mawson's Australasian Antarctic expedition, has been engaged during the southern winter in cruising in sub-antarctic waters. The *Aurora* left Sydney on 18th May under the command of Captain J. K. Davis. Mr. Edgar R. Waite of the Canterbury Museum and an assistant accompanied the ship for biological work. From an article contributed by him to the *Canterbury Times* we learn some particulars of the cruise. The ship was headed for the supposed position of the Royal Company Islands which Captain Davis had previously searched for in vain in the *Nimrod*. After an exhaustive exploration of the region, Captain Davis says definitely that the islands do not exist where laid down in the charts, but adds that, owing to the dirty weather experienced, and the consequent restriction of visibility, there is still a possibility of there being land in the vicinity. The heavy weather prevented soundings, so that no bathymetrical evidence on this problem was obtainable. The attempt was made, but resulted only in the loss of gear. On June 8 Macquarie Island was reached, and the five men left there by Dr. Mawson were found to be well and doing good meteorological work. The expedition's wireless station on Macquarie Island is in excellent working order, and is in daily communication with Sydney, Melbourne, Hobart, and Wellington. The plant has a radius of about two thousand miles, and

on several occasions communication has been made with Suva, Fiji Islands. Up to the time of the *Aurora's* departure, Macquarie Island had failed to pick up any communication from the station Dr. Mawson intended to erect on Adelie Land, but it was believed that possibly Dr. Mawson could receive the messages sent him. Communication has, we understand, since been established, but no messages exchanged. It is pleasing to learn that sea elephants are still abundant on Macquarie Island, since elsewhere they are on the rapid road to extermination. An attempt to trawl off Macquarie Island failed, as did later attempts off the Aucklands, but Captain Davis is determined to master the difficulties of deep-sea trawling, and good results can confidently be looked for on the next voyage. After two weeks of incessant bad weather at Macquarie Island, the *Aurora* left for the Auckland Islands, where a week's stay was divided between Port Ross and Enderby Island. Valuable zoological collections were made here and an abundant supply of rabbits secured for food. These, as well as pigs, goats, and cattle placed there by the New Zealand government in the interests of castaway sailors, have prospered well and increased in numbers. Rabbits are extraordinarily abundant. On July 11 the *Aurora* returned to Lyttelton, New Zealand. In the southern spring, Captain Davis will take her south again to Wilkes Land, starting from Hobart, Tasmania. It is intended to do oceanographical work on the way, for which purpose the ship is well equipped, largely on the lines of the *Scotia*, and with some of that ship's gear lent to Dr. Mawson by Dr. W. S. Bruce. Better weather will no doubt be experienced at that season, and Captain Davis has great hopes of doing important work.

## General.

**The Livingstone Centenary.**—The Society will celebrate this Centenary, which falls, it will be remembered, next year, by a special meeting to be held towards the end of March 1913. It is expected that Sir Harry Johnston will be present at this meeting and will deliver an address, which will be repeated in Glasgow. It is hoped also that other gentlemen who have taken part in the development of Africa will be present.

The Royal Geographical Society of London is also taking steps to celebrate the centenary. It will hold a special meeting on March 17, when Sir Harry Johnston is to give an address, and it is expected that Sir John Kirk, the only surviving companion of Livingstone on his great expedition of 1858-64, will be present. The London Society is also arranging an exhibition of Livingstone relics, including autograph maps, Livingstone's sextant, compass, etc., with portraits and views and a section of the tree under which Livingstone's heart was buried, with the rude inscription carved by his native followers.

**The Proposed Edinburgh Zoological Garden.**—In his address to section D (Zoology) at the Dundee meeting of the British Association, Dr. Chalmers Mitchell, President of the section, alluded to the above proposal in the following terms: "Perhaps I may be allowed to

say how much I hope that the efforts of the Zoological Society of Scotland will be successful, and that, before many months are over, there will be a zoological park in the capital of Scotland. There is no reason of situation or of climate which can be urged against it. The smoke and fog of London are much more baleful to animals than the east winds of Edinburgh. The gardens of North Germany and the excellent institution at Copenhagen have to endure winters much more severe than those of lowland Scotland, whilst the arctic winter and tropical summer of New York form a particularly unfortunate combination, and none the less the Bronx Park at New York is one of the most delightful menageries in existence." Dr. Mitchell, who devoted his whole address to Zoological Gardens and the Preservation of Fauna, went on to point out the value, from many different points of view, of collections of living wild animals, and to speak of the progress which has been made of recent years in methods, and his address should do much to stimulate the work of the Zoological Society of Scotland.

**Distribution and Causation of Pellagra.**—We have noted here on various occasions the results of recent investigations on the subject of pellagra, the disease so widely prevalent among Italian peasants, as well as in Southern Europe generally. By the aid of funds supplied by Mr. H. S. Wellcome, Dr. Sambon has been continuing his work on the subject, assisted by Dr. Chalmers, the two having travelled extensively through the south of Europe, and also visited Egypt. The result of the renewed investigation has been to strengthen the chain of evidence which goes to show that pellagra is a fly-borne parasitic disease, the carriers being flies of the family Simuliidæ. In detail many interesting analogies between the disease and malaria have been worked out. For example, as in the case of malaria, the children in endemic centres are found to be infected from early infancy, and a place cannot be regarded as such a centre unless the symptoms appear in children who have never left the vicinity. Again, just as malaria is associated with standing water, so pellagra is associated with swift-running streams, and the condition of the streams affects the prevalence of the disease. Thus in Oviedo in Spain thirty years ago pellagra occurred along the banks of two rivers investigated by Casal. At the present day the disease has all but disappeared from the banks of one—the Nalon—the suggested explanation being that the industrial establishments which have arisen on its banks recently have so polluted the waters that animal life has disappeared.

Like malaria, pellagra is a disease which shows a seasonal recurrence, with periods of latency. In Roumania acute symptoms appear in persons previously affected each year in March, but in new cases the symptoms do not develop till later, in April or May. The presumption is that the interval allows the sand-flies to become infected, and gives time for the parasite to run through the fly cycle, so that the insects become capable of transmitting the disease. In the French Landes pellagra and malaria have disappeared simultaneously with drainage.

Drs. Sambon and Chalmers have also made very detailed studies of

the distribution of the disease in the vicinity of Venice, and have been able to show that it appears here only in the males of such islands as Burano where the men and boys go to the mainland to fish, and are bitten by the flies which haunt coastal streams. The fact that their wives and children, except in the case of boys old enough to go fishing, are immune from the disease, seems to exclude the idea that there can be direct contagion, or that the disease has anything to do with food. The point is of great geographical importance, because pellagra is a disease almost confined to the agriculturist and to those like inshore fishermen whose occupation brings them into direct contact with the land. Like the hookworm now known to be so widespread in the Southern United States, it has an enormous effect upon the productivity of the land, by diminishing the capacity – both physical and mental—of the worker, and there can be no doubt that it is one important factor in producing the poverty of the Italian peasant. The fact stated above, that infants of a few months old are found to be infected, is analogous to the early infection of the "poor whites" of the Southern United States, and no doubt involves an arrest of development. In both cases the elimination of the disease should bring with it a marked rise in the efficiency, and therefore of the prosperity, of the rural population.

## EDUCATIONAL.

**Report of the Progress of the Ordnance Survey.**—The last issue of this Report, dated 1912, which is the first to appear since Colonel Close became director-general of the survey, contains a good many points of interest to teachers. Thus there is much hope for the future in the frank statement that "it is certain that improvements can be effected in our standard small scale maps." Among the improvements of which there is apparently immediate prospect is the disappearance from the 1-inch-to-the-mile map of the change in the contouring at the 1000-foot level. At present, it will be remembered, the contours are drawn at intervals of 100 feet below this level, and at intervals of 250 feet above it. This gives a very deceptive appearance to the map, and, especially in teaching, it is very difficult to get inexperienced persons to allow for the change in estimating slopes. Another change which has actually taken place is the withdrawal of two of the four forms of the 1-inch map from circulation, these being the map printed in black, with black hachured hills, and that printed in black with brown hachured hills. There remain now, therefore, only two types, the coloured map, and the black outline map printed from copper.

Another interesting point is the forthcoming issue of sheets of the half-inch map with hypsometrical colouring. The paragraph relating to this map may be quoted in full, as it is of considerable interest:—"The first half-inch map of the United Kingdom which achieved any considerable degree of popularity was the half-inch map on the 'layer' system (*i.e.* hypsometrically coloured) produced and published by Mr. J. Bartholomew. This was based on the Ordnance 1-inch maps. They were

particularly in request by officers of the army. Mr. Bartholomew has the credit of popularising this scale, and of familiarising the British public with hypsometrical colouring. After some years of discussion the War Office decided that it was in the national interest that official maps of this type should be used by the army for training and manœuvres, and the Ordnance Survey was accordingly requested to prepare them. Owing to circumstances which it is not here necessary to dwell upon, the issues of this map have up to the present time been of a provisional character, largely on account of the fact that the maps were not engraved but zincographed (a much less satisfactory method of reproduction). During the course of the year 1912-13 sheets of this map in its final form will be published; many of these sheets were in an advanced state of preparation at the end of the year under review. The engraving of six English sheets and of fourteen Irish sheets is nearly completed, and four Scotch sheets are in hand."

It is rather interesting to note from this that those in authority are waking up to the fact that it is a private firm and not the Ordnance Survey which for many years has been educating the general public in the use of topographical maps. At the discussion on the International Map of the World at the Dundee meeting of the British Association, one of the objections put forward to the hypsometrical colouring of that map was that the general public would certainly regard the regions marked brown or yellow as deserts, and those marked green as fields—an objection which showed a curious blindness to the fact that the general public has been using Bartholomew's maps for cycling and walking for years, and had acquired by the only method,—the practical one—a very considerable facility in map-reading.

Another very frank admission in the report is that:—"So far as the mean sea-level is concerned, the datum in use on Ordnance maps at present has no scientific value. Steps are being taken to determine, with all attainable precision, satisfactory values of mean sea-level in Cornwall and on the North Sea." In various other respects also, improvement is promised in connection with the maps in the near future.

We note that, during the year under consideration, 54,418 copies of Ordnance Survey maps have been supplied for the use of schools, and hope that with the other signs of new energy at the Ordnance Survey Office further consideration of the needs of schools may be given, for instance in connection with the cheap supply of batches of representative sheets, after the plan adopted by the German Ordnance Survey Office (cf. p. 270).

## NEW BOOKS.

### EUROPE.

*Explanatory Handbook.* Set I. *Europe.* London: Geo. Philip and Son, Ltd., 1911. *Price 6d. net.*

This is the first of a series of handbooks to be published in connection with a comparative series of wall atlases of the continents which the publishers are

bringing out under the joint editorship of Messrs. Unstead and Taylor. It gives a fresh and interesting account of the geography of Europe, and is accompanied by questions and exercises. We notice that the authors state that "the vine flourishes in successively lower latitudes towards the east" in Europe. No doubt this is a part of the truth, but surely a comparison of the vineyards of Posen with those of western France will show that it is only a part.

*Tramps through Tyrol: Life, Sport and Legend.* By FREDERICK WOLCOTT STODDARD ("Dolomite"). London: Mills and Boon, 1912. *Price* 7*s.* 6*d.*

This nicely got-up book consists of a series of chapters on Tyrol, and includes general accounts of various parts of it, more detailed descriptions of particular walking tours, chapters on sport in summer and winter, Tyrolese legends and so forth. Some of the chapters are stated to have appeared in various periodicals, and though the book fairly well makes the round of Tyrol, the impression produced is one of scrappiness, the author apparently not having quite made up his mind as to the kind of book he wished to write. But as yet the literature on Tyrol is not very extensive, and intending travellers to the country will pick up from the book various useful hints, while those who have already visited it will be glad to revive their memories in Mr. Stoddard's pages. There is an excellent Austrian map of Tyrol and Voralberg, but we note as a curious fact that while German words in the text are carefully translated, no explanation is offered of the rather elaborate lettering of the map. It seems a little hard that the reader who requires to have *Trinkgeld* explained to him should be left to wrestle alone with such terms as *Bezirkshauptmannschaftsort.*

There are a number of fine illustrations, that of the Vajolet Thürme, which forms the frontispiece, being especially striking.

## AFRICA.

*Through the Heart of Africa.* By FRANK H. MELLAND, F.R.G.S., F.Z.S., F.R.A.I., and EDWARD H. CHOLMELEY, F.R.A.I. London: Constable and Company, Ltd., 1912. *Price* 12*s.* 6*d. net.*

It is undoubtedly difficult nowadays to write a book dealing with the somewhat hackneyed subject of a tour in East Africa which shall be fresh and interesting, but unquestionably the two Rhodesian civil servants, who are responsible for the volume now before us, have succeeded in doing so. They were coming home on furlough in 1910, and, "inspired by a craving to know something of what lay beyond" them, they decided to combine investigation with sport; and so, starting from North-West Rhodesia in July, they made their way in six months to Gondokoro, covering "altogether 3,020 miles, of which 1,720 had been walking and cycling, 607 by lake steamers, 520 on the Uganda railway, and the balance by motor vans in the East Africa and Uganda Protectorate." Of course their previous experience of official life in Rhodesia, their command of some of the languages, and their personal acquaintance with several of the officials in the territories they were to pass through, gave them considerable advantages, in addition to which it is very evident that they had no difficulty in ingratiating themselves with all classes of natives, from ruling chiefs down to humble porters. Then they were skilful sportsmen, accustomed to camp life and to roughing it, each endowed with a powerful physique, considerable fertility of resource, and a happy sense of humour. So far as literary merit is concerned the book is written in a simple, graceful, breezy style which, we are free to confess, we do not com-

monly find in the works of civilian officials. The writers give us the impression that they enjoyed the literary part of their work quite as much as they did an elephant hunt or a race meeting. There is no attempt at fine writing or at expatiating on personal incidents. But there is ample evidence that the authors made the best use of their exceptional advantages and opportunities, and we have, as a result, a volume replete with varied description and information, the interest of which never flags. The ethnologist will find here valuable notes on the religious beliefs and customs of some of the lesser known tribes, and some quaint folklore legends of the creation of the world, of mankind, etc. The politician will find a dispassionate and discriminating account of what two experienced British officers observed and noted as to the system of administration in German East Africa; and it is pleasant to find that they received every kindness, hospitality and help from the German officials. Of the German administration they say: "The most outstanding feature of the German administration is without doubt the thorough way in which they investigate and experiment on the possibilities of the territory. The way in which they have fostered and organised trade up country deserves every praise. The roads that have been made are excellent, and the manner in which they are pushing on railway construction calls for a good deal of admiration. Thoroughly and systematically conducted, it presents a rather marked contrast to the usual haphazard British methods. . . . On the whole, considering how new colonial work is to the German nation, they have every reason to be proud of what they are doing in their East African Protectorate." If the authors' remarks on the German administration are valuable, much more so are their criticisms of the British administration of the Uganda Protectorate. Approving cordially of the system of decentralisation and of government as much as possible through the local chiefs, the authors set forth with much acumen some of the weak points in the system, laying special emphasis on the low standard of integrity and morality which is necessarily found among the ruling chiefs: and they certainly put their finger on two grave but easily remediable flaws of administration, viz., the continual changes of officers from one station to another, and their ignorance of the language. In India it is required of all administrative officers that they spend several months of each year in camp in their districts, thereby coming into direct contact with all classes of natives, learning their language, and acquiring a first-hand knowledge of their life, customs, beliefs, prejudices, etc., without which a civil officer is helpless and often worse than useless. On the other hand, the natives get to know and understand their rulers, and can tell them their own story in their own way, a privilege the value of which cannot be overestimated. There is no reason why this rule of administration should not be introduced into Uganda, where it would undoubtedly have the most beneficial results to both the administrators and the people. Limitations of space prevent us from more than referring to the crisp and graphic narratives of sport of which there are plenty, to the very useful hints and advice given to intending immigrants and sportsmen, or to the continuation of the story of the journey, when the authors left Uganda and proceeded down the Nile to Cairo, where of course they were on the beaten track, but they contrive to give the reader a fresh and interesting account of their hurried visits to Khartoum, Luxor, etc. The volume is profusely illustrated with excellent photographs, and there is a good map. From various hints in the book we gather that the authors may be tempted to undertake another similar expedition in some other part of East Africa, and we conclude with expressing our sincere hope that they will be able to do so, and to compile as interesting and instructive a work as the one now before us.

*The Ridge of the White Waters (Witwatersrand).* By William Charles Scully. London: Stanley Paul and Co., 1912. *Price* 6*s. net.*

The author of this book can claim an old acquaintance with Johannesburg, for he tells us that he once hunted blesboks on its site. This was more than thirty years ago. In this volume he describes how he lately revisited his old haunts, and he gives us his impressions of what Johannesburg now is. On the whole he paints a gloomy, almost a lurid, picture, one which will not tempt the investment of British capital in the famous Rand, nor will it tend to promote emigration to the gold mines. He has an unbounded distrust of the Rand magnates, and denounces their lying prospectuses. He shows a considerable knowledge of life in the mines, and depicts the dangers incidental to it with an unsparing hand. "The prosperity of the Rand," he says, "is based upon abnormal and impermanent conditions. The life at Johannesburg is, for most of the people who live there, extremely demoralising. It is a place where no ideals can survive, where family ties tend to slacken and dissolve. Three years spent on the Rand, in its feverish, strenuous environment, weighed upon by the sense of impermanency, and with nerves overstrung by the unusually arid climate and the altitude, are calculated to unfit the average human being for life elsewhere." The book is illustrated with a number of good photographs.

*A Lost Legionary in South Africa.* By Col. L. Hamilton-Browne. London: T. Werner Laurie, 1912. *Price* 12*s.* 6*d. net.*

Much water has run below the bridge since Great Britain was shocked by the news of the disaster of Isandlwana, and then, to some extent, reassured by the story of the heroic defence of Rorke's Drift. These tales have passed into ancient history, but they bear retelling, and there is no one better qualified to tell them than the lost legionary, "Maori" Browne. He was in command of a handful of white men, some three hundred fighting Zulus, and about a thousand Natal Kafirs who were unmitigated cowards, a hindrance to him rather than an assistance, and from a short distance he saw the disaster of Isandlwana, but was unable to prevent it. The bulk of the book is taken up with an account of the campaigns of 1878 and 1879, and they are described with the verve and swing and humour which constituted the charm of Colonel Browne's former work *With the Lost Legion in New Zealand*. Besides the story of these campaigns there are many racy anecdotes of the various strange characters whom he met with, native and European. His style is thoroughly unconventional, and a considerable part of the book would not be suitable reading for a Sunday school or an Exeter Hall meeting. We look forward with much interest to the publication of another volume which is to contain an account of "Maori's" adventures in Mashonaland in 1891, and which will "open the eyes of the British public to the acts of some of the men whom at present they regard as little imperialistic tin gods."

## AUSTRALASIA.

*Across Australia.* By Baldwin Spencer, C.M.G., M.A., F.R.S., and F. J. Gillen. Two Vols. London: Macmillan and Co., Ltd., 1912. *Price* 21*s. net.*

The two savants who are responsible for these volumes have taken important parts in several scientific expeditions into the interior of Australia, and have already published several works in which the scientific results of these expeditions have been communicated to the public. In the two volumes now before us they

bring together in less technical and more popular fashion "some of the most interesting things" that they saw for the information of the general reader, and they have succeeded in compiling a very interesting and instructive work. They describe in picturesque and graphic language the topography of the regions through which they travelled, the difficulties and dangers as well as the charms of marching and camping in the Australian bush, and the savage tribes with which they came in contact, recording their legends and folklore, their ceremonies and superstitions, and even some of their music as recorded by a phonograph. They were also keen observers of the animal and vegetable life of the regions through which they passed. Much the most interesting part of the work is the detailed description of the daily life, manners and customs of some of the savage Australian tribes, more especially the Arunta, who inhabit a tract to the south of the M'Donnell Ranges. The authors prepared themselves for this part of their work in no half-hearted way; we do not know exactly how they managed it, but we are told that "one of us had been for long recognised by the natives as a member of the Alice Spring group of witchetty grubs, to which totem, as his younger tribal brother, the other of us was also regarded as belonging. The latter was only one of the common order, but the former was supposed to be the reincarnation of one of the celebrated Alcheringa men whose name was Urangara." The being witchetty grubs of the Alice Springs group entitled them to attend and take part in all tribal and religious ceremonies, a right of which the authors seem to have availed themselves with a patience and perseverance deserving our highest praise and admiration. For example, they describe one corroboree in which "commencing in the middle of September there had been a constant succession of ceremonies, never less then one, and often as many as three, four, and five each day, until nearly the end of December, when the ceremonial ground was dismantled and the visitors from distant parts returned to their own hunting-grounds. To us the whole time had been full of interest. We had been living amongst and witnessing the daily life of savages who were yet in the Stone Age, and whose manners of life, customs and beliefs were akin to those of the early ancestors of mankind—just as the quaint, egg-laying and pouched mammals on which they fed were akin to, in fact the surviving relics of, ancient groups of primitive animals which have elsewhere been replaced by higher forms." It would be easy to expand this notice to many pages by quotations from almost any chapter in this book, but we must content ourselves by referring our readers to the volumes themselves, in which they will find much varied and interesting information on many subjects of which but little is, or can be, known to the general reader. To many the numerous illustrations (some of them coloured) will be not the least interesting part of the work, and it speaks well for the authors' tact and good comradeship that they were able to persuade the savages to permit them to photograph many of their most sacred symbols and ceremonies. There are also excellent representations of some rock pictures found in caves at Ayers' Rock, and there is a useful map showing the route followed by the authors and a rough location of the principal tribes.

## GENERAL.

*High-School Geography: Physical, Economic, and Regional.* By CHARLES REDWAY DRYER, F.G.S.A., F.R.G.S. New York: American Book Company. *Price* $1.30.

This is an extremely interesting and comprehensive book, copiously illustrated both by maps and from photographs. It is divided into three sections:

physical geography, economic geography, and regional geography. In the first we have a general account of the earth, very brief as regards mathematical geography and commendably full as regards the forms of the lands: such conceptions as those of plain, plateau, etc., being illustrated alike by photographs and by contoured maps of particular examples. This first part is followed by a section dealing with the natural resources and food supply of the globe: materials used for clothing and purposes of construction; heat, light, and power; with a final brief chapter on manufacture, trade, and transportation. The third part opens with a division of the globe into natural provinces, "arranged in a few groups, forming typical environments in which the economic adaptations of human life must be broadly similar, varying only with the stage of civilisation of the inhabitants." The result of this arrangement is that the traditional treatment of the globe in continents disappears, as, according to Mr. Banse (cf. *S.G.M.*, p. 377), it should disappear, and we have instead a treatment by regions classified chiefly on a climatic basis.

From this description it will be seen that the book deviates in many ways from the school geography of tradition. Indeed, the author himself admits in his preface that his arrangement may be regarded as "revolutionary," but he believes that when the object of the method is understood it will be accepted and welcomed. According to his view, "To get a view of the earth, not only as the home of man, but as the garden where he has grown, the school in which he has been educated and civilised, the environment in which still higher ideals can be attained, is the object of modern geographical study," and this aim can, he believes, be best realised by the method he has adopted. The value of all such deviations from tradition can only be estimated in actual practice, and we should like to have the opinion of teachers who had used the book in their classes before expressing an opinion upon this particular case. To us the book seems extraordinarily fresh and vigorous, and we believe that intelligent scholars would read parts of it greedily out of lesson hours, extract from it many facts of great interest, and thus be led to regard geography as a subject worth knowing about. Whether they would also obtain from it what is called here a "thorough grounding" in the subject, is perhaps a little more doubtful. An enormous number of subjects are discussed, many necessarily in so condensed a fashion that except under the guidance of a careful teacher the scholar might, we think, carry away erroneous ideas. Again, if the book is intended to be used by the scholar from the beginning of his course, too much knowledge is perhaps assumed, or left to be imparted by the teacher. Thus, in the discussion of the terms latitude and longitude, the words north and south, east and west, are not mentioned, and we doubt if even the intelligent scholar could follow the very summary chain of reasoning which leads to the conclusion that "directions and latitude may be determined by observing the stars." Also, we are not quite sure how the treatment of the world in natural regions would work out in practice. For example, the scholar has in the section on physical geography a very short paragraph on Europe. He is not, so far as we can see, concerned with this continent again till p. 425, when he is suddenly introduced to the Baltic peneplain and the Scandinavian highland. In this the author is no doubt conforming to his principles, but on this side at least we cannot afford to forget that the persons who know what the Baltic peneplain is, are few indeed compared with those who find it desirable that their children should know first where Sweden is. Is there not risk here of falling out of natural relations with the world outside the schoolroom? It is true that later in the chapter the countries of Europe are discussed separately, but we should have preferred to reverse the order of presentation, on the ground that it is better to pass from the familiar to

the unfamiliar. But we must repeat that the book is full of vitality and freshness, and there can be no surer proof that a subject is really progressing than the fact that teachers of reputation are willing to make "revolutionary" experiments. To the teacher here we cordially recommend it as one of great value in presenting novel points of view, and summarising the results of many different lines of research.

*A Class-Book of Physical Geography.* By A. T. Simmons and Ernest Stenhouse. London: Macmillan and Co., Ltd., 1912. *Price 4s. 6d. net.*

This is a small but comprehensive book among whose special features are the number of practical exercises given at the beginnings of the chapters, and the lists of examination questions at the ends, the questions being selected from among those set by the more important examining bodies. The descriptions of the various phenomena are clear and accurate, and the matter is very well arranged. On the whole the emphasis is laid upon the physical side of the subject, and many of the experiments and exercises seem to us to fall rather into the physical course than the geographical one, though this is perhaps a matter which concerns chiefly the school time-table. But the space for these has been obtained at the expense of the subjects in which physical geographers are most keenly interested at the present day. It is true that short chapters are devoted to the geographical distribution of plants, animals, and man, but such subjects as glaciation, the development of river systems, and so forth, are treated in a very summary fashion. The same statement can be made in regard to coastlines. Fiords are dismissed very briefly with no allusion to the possible effect of ice in producing them, though the view that ice does excavate is accepted elsewhere, and we have found no mention of ria coasts. Whether by accident or design many of the terms which the American geographers have introduced of late years are omitted, or mentioned only very briefly. We have a brief account of the peneplain, but subsequent, consequent and obsequent rivers do not seem to be named, and though we find the piedmont plain mentioned, the piedmont glacier is apparently omitted. It seems to us that an examination of current literature would show that physical geographers are devoting more and more attention to details of topography and their causes, and less to purely physical processes, and an elementary text-book should surely give the student a terminology sufficient to enable him to follow current literature. But at present the question as to what should be included in a text-book of physical geography, and what omitted, remains largely a matter of opinion, and along its own lines the book is admirable.

It is copiously illustrated with half-tone blocks in addition to sketch-maps, diagrams, etc. Some of the blocks have not come out well, though others are very successful. The book should be especially useful in schools where the term physical geography is employed in Huxley's sense, as including a general introduction to the principles of science.

*The Depths of the Ocean: A General Account of the Modern Science of Oceanography, based largely on the Scientific Researches of the Norwegian Steamer* Michael Sars *in the North Atlantic.* By Sir John Murray, K.C.B., F.R.S., etc., and Dr. Johann Hjort. With Contributions from Prof. A. Appellöf, Prof. H. H. Gran, and Dr. B. Helland-Hansen. London: Macmillan and Co., Ltd., 1912. *Price 28s. net.*

Frequent references have been made here to the cruise of the *Michael Sars*, and to the main results obtained during its course. The present handsome volume gives not only a full account of the ship and its work, but also a series of general

chapters on various problems of oceanography, so that, in the words of the preface, the book presents the student with a fairly complete epitome of recent advances in the modern science of oceanography.

This science is perhaps the branch of physical geography which has made the most striking advances in recent years, and hitherto the publication of text-books, especially in English, has not kept pace with the advance of the science. Even the larger text-books of physical geography treat the ocean in a very summary fashion, and hitherto the bulky volumes of the *Challenger* expedition have remained the chief source of information in English on the subject, and they of course ante-date the more recent researches. A very cordial welcome will therefore be extended by geographers to this book, with its beautiful maps and illustrations, its numerous diagrams, and its admirable summaries of subjects still being keenly debated and investigated. The co-operation of the Director of Norwegian Fisheries and of several of his colleagues results in particularly full accounts being given of recent Norwegian investigations, and it is well known that it is to Norwegian investigators that the science of oceanography is indebted for some of the recent great advances, and for the elaboration of delicate and complicated methods which promise even greater progress in the near future.

The natural result of this co-operation is that, though the discussions are not strictly limited to the Atlantic, yet they chiefly concern that ocean, to which of course the cruise of the *Michael Sars* was confined. In a sense indeed the volume is a combination of two books—a treatise on oceanography and an account of the cruise of the *Michael Sars*, and we are personally a little disposed to regret that the latter section is given so much space. A comprehensive text-book in English is so badly needed that we are disposed to grudge the space given to the details of the cruise.

Space does not permit us to note all the subjects discussed in the book, and we can only pick out a few points of special interest. Among the chapters giving summaries of present knowledge, we may single out Sir John Murray's contribution on the depths and deposits of the ocean, which is illustrated by three exceedingly useful maps, and deals with the oceans in general, the account of all the known "deeps" being especially valuable. Dr. Hjort's chapters on the fishes from the sea bottom, the pelagic animals, and the general biology of marine animals, which are fully and beautifully illustrated, are also worth special note.

Among the subjects upon which special light was thrown by the *Michael Sars* investigations are the existence of currents in deep water, the vertical distribution of deep-sea fishes and the distribution of pelagic organisms. In regard to the first point, the investigators succeeded in showing that at depths of 800 metres relatively strong currents exist which must sweep pelagic deposits away from ridges and banks, while current action can be shown to exist even in the great depths. This fact is of considerable biological interest, because it has been proved that in shallow water the places where the bottom water is in motion are specially haunted by fish, for here a fine cloud of organic matter is swept along which attracts mud-eating organisms. Now the *Michael Sars* took good hauls of ground-living forms in regions where Globigerina ooze formed the ground-deposit, and it is believed that here also the movements of the bottom waters have an important effect. Dr. Peach's investigations (cf. p. 344) on the stones dredged from the floor of the Atlantic show also that deposits of Globigerina ooze are being eroded by current action in deep water. The investigation of the vertical distribution of bathypelagic fishes and crustacea brought out some very interesting relations between the colouring and the intensity of light, while the plankton investigations confirmed previous

observations in regard to the marked irregularities of distribution. Warmth and light do not, as might be supposed, control its great abundance in certain places, for larger masses of minute algae have been found in temperate than in tropical and sub-tropical seas, and in the temperate seas the warmest months are not those when the plankton is most abundant. It is believed that on the other hand vertical currents have great importance, and that generally regions of ascending currents have a rich plankton, while those where the surface layer is continually descending are more or less sterile. The whole subject is difficult and much debated, and much more elaborate investigations will have to be made before final conclusions can be drawn.

These are only a few of the subjects upon which the *Michael Sars* investigations have cast light, or have revealed the obscurities which still exist. The fact that so much was done with a small boat is full of hope for the future, and geographers will be grateful to Sir John Murray not only for his generosity in providing the funds for this cruise, but also for his courage in attempting such an elaborate series of investigations on so small a vessel, and thus proving that much oceanographical research can be done successfully by private enterprise.

*The Secret of the Pacific.* By C. Reginald Enoch, F.R.G.S. London: T. Fisher Unwin, 1912. *Price* 12*s.* 6*d. net.*

This interesting and thoughtful work bears on a vast, intricate and perplexing problem, and brings to its solution an immense amount of valuable information, but to the dismay of the reader he is left at the end no nearer the solution than when he began the perusal of the book. The problem is what was the origin of the ancient civilisations of America, the Toltecs, the Aztecs, the Mayas, the Incas and their predecessors. "What was their orgin? What was their connection with each other? Had they any link with the Old World? Did they in olden times draw inspiration and knowledge from Asia, Egypt, Babylon? If not, and they sprang unaided from their own soil, and created their own culture, what were the conditions of their independent development?" On this huge and difficult subject much light has been thrown by various writers and investigators such as Humboldt, Holmes, Bancroft, Brinton, to mention only a few. But amongst living students undoubtedly no one has earned a greater reputation or can speak with greater authority than Mr. Enoch, who has already published several valuable books, all more or less bearing on this subject, and thus when he can come to no definite conclusion the feeling of disappointment is all the greater. He himself tell us that this work is but a "fragmentary *résumé*" compiled from the real fountain heads of knowledge. To lift the veil from the past, he says, is a task which "can only be carried out by those who command full leisure and the wherewithal for its accomplishment. To perform it adequately we should have to ransack Europe, Asia, Africa, and America, not only on library shelves, but in museums, tombs, ruins, deserts, and mountains. Ample time and a long purse are the adjuncts, coupled with that philosophical love of the past doings of mankind—not simply as being antique, but as bearing upon life and time as a whole, which furnishes the true detective-faculty of the investigator—which will, as time goes on, solve the secret of the Pacific." But this need not prevent us acknowledging the valuable compendium of facts which Mr. Enoch has patiently and assiduously collected in this volume, and the equally valuable hints and suggestions he has given as to how farther investigation may be made. The subject has a fascination for various classes of students, all of whom will find in these interesting pages a wealth of material to assist them in their own departments of study. The numerous and varied illustrations are exceptionally good and suggestive.

*Britain in the Tropics.* By A. Wyott Tilby. London: Constable and Company, Limited, 1912. *Price* 6*s. net.*

In this, the fourth, volume of "The English People Overseas" series, the author undertakes a task as ambitious as it is difficult. Into a compendium of 450 pages he compresses the history of the British Empire in the tropics during four centuries, viz., 1527 to 1910, and it is to be noted that he does not exclude from his survey former possessions of Great Britain which she no longer holds, having lost them by war or diplomacy. On the contrary, some of his most instructive and interesting pages tell the story of the failure to retain her possessions, *e.g.* in South America, Java, etc. The result is a series of historical sketches somewhat unequal in breadth and depth of treatment, and of varied but unequal interest. In one sense there is not a chapter in the book which is devoid of great interest, and the writer has evidently spared no pains to acquire a complete mastery of his subject, to which we must add that he sets forth the history of the varying fortunes and the vicissitudes of the history of our empire in the tropics with a patriotic enthusiasm and a literary skill which leave little to be desired. He is an imperialist in the best sense of the word, but this does not prevent him from setting forth the principles and views of the "little Englanders," *e.g.*, Cobden, with conspicuous ability and impartiality. He does not burden his work or weary his reader with statistics or details, while on the other hand the action and results of the personal equation in diplomacy and history are neither concealed nor minimised. A very useful feature of the book is the bibliography of authorities to which a student, desirous of making a special study of any period of the history, may refer.

*Corals and Atolls: A History and Description of the Keeling-Cocos Islands, with an Account of their Fauna and Flora, and a Discussion of the Method of Development and Transformation of Coral Structures in General.* By F. Wood-Jones, D.Sc., F.Z.S., etc. Reissue. London: Lovell, Reeve and Co., Ltd., 1912. *Price* 15*s.*

Although styled a reissue this volume is in a sense a second edition, as some new matter, derived from the report of the *Michael Sars* North Atlantic deep-sea expedition, and from the researches of Mr. A. R. Hunt, has been added to chapter xxi. This chapter contains Dr. Wood-Jones's conclusions as to the method of development of reef bank and the reef. A most important statement is that "an area in which sedimentation is taking place is one in which the reef-builders will not flourish" (p. 243). In other words, among the conditions necessary to the activity of the coral polyp absence of sediment is the chief. Thus the lagoon is caused by the waves washing débris from the edge towards the interior, killing the zooids already established there, and preventing the growth of new colonies. The familiar annular shape of atolls is due to winds and ocean currents. While it is not denied that subsidence occurs and has occurred, the author insists that his theory contains all the elements of a complete explanation, and that it is merely an extension of the famous theory of Darwin. Dr. Wood-Jones resided in Cocos-Keeling atoll for fifteen months, and his whole time was employed in close observation of the reef-building corals, and in tabulating the flora and fauna of the various islands. Part I. contains an account of the discovery and early history of the islands, of the origin of the Clunies-Ross family in whose hands the islands still remain, a history of the atoll from 1825 onwards, and a chapter on native customs. Part II. deals with the corals, Part III. with the atoll, and Part IV. with the flora and fauna. There are lists of the fauna and

flora, a short bibliography, a good index, a map, diagrams, and numerous illustrations. We cordially recommend the book, not only as bringing up to date the story of the coral, but for its account of the romantic history of the Clunies-Ross family, similar in some respects to that of the Brookes of Sarawak.

*Palestine and Syria: With Routes Through Mesopotamia and Babylonia and the Island of Cyprus.* Handbook for Travellers. By KARL BAEDEKER. Fifth Edition remodelled and augmented. *Price* 14*s. net.*

*Southern Italy and Sicily: With Excursions to Sardinia, Malta, and Corfu.* Handbook for Travellers. By KARL BAEDEKER. Sixteenth Revised Edition. Leipzig: Karl Baedeker, 1912. *Price* 6*s. net.*

Of these two guidebooks the former contains for the first time a description of the Island of Cyprus. The description runs to eighteen pages, and is illustrated by some useful maps. Certain of the other maps also have been redrawn or modified. The Italian volume also has been thoroughly revised, and contains some new maps. It has now become an impertinence to praise a Baedeker, but there are two points in regard to the information about luggage in the Italian volume to which we should like to draw the attention of the editor. The first is the statement that "travellers who confine their impedimenta to articles that they can carry themselves and take into the carriage with them will be spared much expense and annoyance." The obvious reply is that they will inflict an enormous amount of annoyance upon their fellow-travellers. Any one who has seen the mountains of "hand luggage" which the average Italian traveller takes into the carriage with him, will agree that for a British traveller to attempt to add to it the luggage necessary to a person experiencing such a marked change of climate as that from the British Isles to Italy, is to ensure that all the persons concerned will lose their tempers. In view of the fearful overcrowding of Italian trains during the season we think the sentence might very well be omitted or modified. The other point is that fuller prominence should be given to the railway officials' habit of roping and sealing trunks which they regard as insufficiently secured. No subject more frequently gives rise to dispute in an Italian station, and the rope for which the official charges at least a lira can be bought for a few soldi in a shop by the prudent and economical traveller of experience. The information given in "Baedeker" does not prepare the inexperienced either for the fee charged or for the fact that the process of roping and sealing is carried out without his consent or foreknowledge.

*An Introduction to Physical Geography.* By MARION I. NEWBIGIN, D.Sc. London: J. M. Dent and Sons, 1912. *Price* 3*s.* 6*d.*

This latest class-book of physical geography covers all the subject required in schools, and will carry pupils up to the university standard. Despite many other volumes of like pretensions there was ample room for this book, and we welcome it on account of its many excellent features. Firstly, the book is readable throughout, and has a unity which most such books lack with their endless disjointed paragraphs and excursions into various aspects of elementary science. Secondly, the author has kept in touch with the human aspect of her subject throughout, and so helped to diminish the usual gulf between physical and human geography. Thirdly, the treatment is thoroughly concrete, and avoids abstract discussions of hypothetical cases which always convey an impression of unreality to the pupil. Lastly, to mention only one other good point, we are glad to see that Miss Newbigin breaks away from the conventional but unsatisfactory method of beginning with mathematical geography. She begins with features of relief which

are something intelligible to the young student; it is only later in the volume that we find astronomical considerations.

The volume is lucidly written, well illustrated with many diagrams and maps, most of them new, and contains useful references to further reading and to the latest research. It should be widely used in schools as a reliable and useful work.

*Brown's Nautical Almanack for* 1912. Edited by JAMES R. BROWN, assisted by H. B. GOODWIN. Glasgow: James Brown and Son. *Price* 1*s.* 6*d. net.*

A nautical almanack is indispensable to the teacher who wishes to make his class work problems in mathematical geography, and we would draw attention to this one as excellent in arrangement, and compact in size.

*Monograph on the Sub-Oceanic Physiography of the North Atlantic Ocean.* By EDWARD HULL, M.A., LL.D., F.R.S. With a Chapter on the Sub-Oceanic Physical Features off the Coast of North America and the West Indian Islands, by Prof. JOSEPH W. WINTHROP SPENCER, M.A., Ph.D. London: Edward Stanford, 1912. *Price* 21*s. net.*

This is a beautifully produced monograph of large size, illustrated by a number of maps and charts. The text gives an account of those curious valleys and cañons which have been followed by various observers across the continental shelf off the coasts of Europe, Africa, and America, but the description given here is with the object of supporting a special thesis in regard to the origin of the Ice Age. Briefly put, Professor Hull believes that in the Tertiary times there was a general uplift of the ocean bed of the Atlantic to the extent of 6000 to 7000 feet or more, and that this uplift was the cause of the Ice Age, partly because of the diversion of the Gulf Stream. It does not seem to us quite clear for whom the monograph is intended, for on the one hand it includes very elementary explanations which would hardly be needed by the geographer or geologist, while on the other the cost and elaboration of the volume seem to exclude the idea of a purely "popular" appeal.

The existence of submerged river valleys over the continental shelf is of course one of the interesting observations which we owe to the careful soundings which have been made of recent years, and Dr. Hull's accounts of these, together with the chapter contributed by Professor Spencer, who has done so much to investigate the submerged river valleys of America, will be cordially welcomed by oceanographers. The theoretical conclusions which the former author seeks to draw from the facts take us to more difficult ground, and we can only say here that some of the reasoning appears to us to suffer from the fact that certain recent investigations and conclusions have not received the attention they deserve. Many changes have taken place since Lyell wrote his famous *Principles*, and we can scarcely doubt that many of his views would have undergone modification had he been living at the present day.

*The Making of the Earth.* By J. W. GREGORY, Professor of Geology at the University of Glasgow. Home University Library. London: Williams and Norgate. *Price* 1*s. net.*

This is a delightful little book, rendering available to the general public a large mass of material which would otherwise require to be sought for in a great variety of technical publications. It seems to us to fulfil in the most admirable manner one of the purposes of the series to which it belongs, that of showing the non-

specialist scientific deductions in the making, and thus suggesting the fascination of fitting together fragments of evidence to form a whole which will stand the test of time. The book contains a great mass of speculative matter, and we do not suppose that Professor Gregory would maintain that all the theories and suggestions put forward are likely to become permanently incorporated in that body of ascertained fact which we call science, but by its freshness and vigour the book is likely to give the reader something more valuable even than a collection of ascertained facts, and that is a permanent interest in natural phenomena.

The book traces the history of the earth from the primordial nebula, if not to man, at least to the first appearance of life upon the earth in Protobion, the hypothetical first living thing. We have ourselves found the earlier parts, those dealing with the origin of the earth and the growth of its surface, the most interesting; but this is doubtless a personal matter, and others may prefer the discussions of the probable circumstances under which life originated.

## BOOKS RECEIVED.

*Troy: A Study in Homeric Geography.* By WALTER LEAF, Litt.D., Hon. D.Litt. (Oxon.). With Maps, Plans, and Illustrations. Demy 8vo. Pp. xvi + 406. *Price* 12*s. net.* London: Macmillan and Co., Ltd., 1912.

*My Sudan Year.* By E. S. STEVEN. With 40 Illustrations. Demy 8vo. Pp. x + 305. *Price* 10*s.* 6*d. net.* London: Mills and Boon, Ltd., 1912.

*Russia.* By Sir DONALD MACKENZIE WALLACE, K.C.I.E., K.C.V.O. Revised and Enlarged Edition. With Maps. Demy 8vo. Pp. x + 788. *Price* 12*s.* 6*d. net.* London: Cassell and Co., Ltd., 1912.

*The Cambridge Manuals of Science and Literature:—*

*The Civilisation of Ancient Mexico.* By LEWIS SPENCE. Cr. 8vo. Pp. viii + 121. *Price* 1*s. net.*

*The Work of Rain and Rivers.* By T. G. BONNEY, Sc.D., LL.D., F.R.S. Cr. 8vo. Pp. 144. *Price* 1*s. net.*

*China and the Manchus.* By HERBERT A. GILES, M.A., LL.D. Cr. 8vo. Pp. viii + 148. *Price* 1*s. net.* Cambridge: University Press, 1912.

*A Tramp's Sketches.* By STEPHEN GRAHAM. Demy 8vo. Pp. xiii + 339. *Price* 5*s. net.* London: Macmillan and Co., Ltd., 1912.

*In French Africa: Scenes and Memoirs.* By Miss BETHAM-EDWARDS. Illustrated by Original and Copyright Photographs. Demy 8vo. Pp. ix + 324. *Price* 10*s.* 6*d. net.* London: Chapman and Hall, Ltd., 1912.

*Joseph Pennell's Pictures of the Panama Canal.* Reproductions of a Series of Lithographs made by him on the Isthmus of Panama, January-March 1912, together with Impressions and Notes by the Artist. Royal 8vo. Pp. 14 and 28 Plates. *Price* 5*s. net.* London: Wm. Heinemann, 1912.

*Das Gesetz der Wüstenbildung in Gegenwart und Vorzeit.* Von JOHANNES WALTHER. Mit 147 Abbildungen. Royal 8vo. Pp. xv + 342. *Preis* M. 12. Leipzig: Quelle und Meyer, 1912.

*Cities seen in East and West.* By Mrs. WALTER TIBBITS. With 34 Illustrations. Demy 8vo. Pp. xix + 338. London: Hurst and Blackett, Ltd., 1912.

*Au Pays de Salammbô.* Par MARTIAL DOUËL. Préface de RENÉ CAGNAT. Cr. 8vo. Pp. 270. *Prix* 3.50. Paris: Fontemoing et Cie, 1911.

*The Essentials of World Geography for Junior Students.* By J. F. UNSTEAD, M.A., D.Sc., and E. G. R. TAYLOR, B.Sc. With 73 Maps and Diagrams. Cr. 8vo. Pp. vi + 249. *Price* 2*s.* London: George Philip and Son, Ltd., 1912.

*Venezuela.* By LEONARD V. DALTON, B.Sc. (Lond.). With a Map and 34 Illustrations. Demy 8vo. Pp. 320. *Price* 10*s.* 6*d. net.* London: T. Fisher Unwin, 1912.

*The Story of Lucca* (The Mediæval Town Series). By JANET ROSS and NELLY ERICKSEN. Illustrated by NELLY ERICKSEN. 12mo. Pp. xiii + 365. *Price* 4*s.* 6*d. net.* London: J. M. Dent and Sons, Ltd., 1912.

*Information about Bolivia.* Demy 8vo. Pp. 72. Washington, D.C.: Bolivia Legation, 1912.

*A Modern Pilgrim in Mecca, and a Siege in Sanaa.* By A. J. B. WAVELL, F.R.G.S. Illustrated. Demy 8vo. Pp. ix + 342. *Price* 10*s.* 6*d. net.* London: Constable and Co., Ltd., 1912.

*Warfare in England* (Home University Library of Modern Knowledge). By HILAIRE BELLOC. 12mo. Pp. 254. *Price* 1*s. net.* London: Williams and Norgate, 1912.

*Missions: Their Rise and Development* (Home University Library of Modern Knowledge). By LOUISE CREIGHTON. 12mo. Pp. 256. *Price* 1*s. net.* London: Williams and Norgate, 1912.

*Narrative of the Visit to India of Their Majesties King George V. and Queen Mary and of the Coronation Durbar held at Delhi 12th December* 1911. By The Hon. JOHN FORTESCUE. Demy 8vo. Pp. viii + 324. *Price* 10*s.* 6*d. net.* London: Macmillan and Co., Ltd., 1912.

*Rambles in Ireland.* By ROBERT LYND. With 5 Illustrations in Colour by JACK B. YEATS, and 25 from Photographs. Cr. 8vo. Pp. 312. *Price* 6*s.* London: Mills and Boon, Ltd., 1912.

*Florida Trails as seen from Jacksonville to Key West, and from November to April inclusive.* By WINTHROP PACKARD. Illustrated from Photographs by the Author and others. Demy 8vo. Pp. 300. *Price* 7*s.* 6*d. net.* London: Frank Palmer, 1912.

*Map Projections.* By ARTHUR R. HINKS, M.A. Demy 8vo. Pp. xii + 126. *Price* 5*s. net.* Cambridge: University Press, 1912.

*Edinburgh.* By R. L. STEVENSON. With 24 Illustrations in Colour by JAMES HERON. Cr. 4to. Pp. 208. *Price* 12*s.* 6*d. net.* London: Seeley, Service and Co., Ltd., 1912.

*Through Holland in the* Vivette: *the Cruise of a 4-Tonner from the Solent to the Zuyder Zee, through the Dutch Waterways.* By E. KEBLE CHATTERTON. With over 60 Illustrations, Harbour Plans, and Charts. Sq. Ex.-Royal 8vo. Pp. 247. *Price* 6*s. net.* London: Seeley, Service and Co., Ltd., 1912.

*Among Congo Cannibals: Experiences, Impressions, and Adventures during a Thirty Years' Sojourn amongst the Boloki and other Congo Tribes, with a Description of their curious Habits, Customs, Religion, and Laws.* By JOHN H. WEEKS. With 54 Illustrations and a Map. Demy 8vo. Pp. 352. *Price* 16*s. net.* London: Seeley, Service and Co., Ltd., 1912.

*Things seen in Palestine.* By A. GOODRICH-FREER, F.R.S.G.S. (Mrs. H. H. SPOER). With 50 Illustrations. 12mo. Pp. 254. *Price* 2*s. net.* London: Seeley, Service and Co., Ltd., 1913.

*Things seen in Russia.* By W. BARNES STEVENI. With 50 Illustrations. 12mo. Pp. 258. *Price* 2*s. net.* London: Seeley, Service and Co., Ltd., 1913.

*By Flood and Field: Adventures Ashore and Afloat in North Australia.* By ALFRED SEARCY. Demy 8vo. Pp. 327. *Price* 6*s. net.* London: G. Bell and Sons, Ltd., 1912.

*The Sea Trader: His Friends and Enemies.* By DAVID HANNAY. Illustrated. Demy 8vo. Pp. xi + 388. *Price* 15*s. net.* London: Harper and Brothers, 1912.

*From the Black Mountains to Waziristan: Being an Account of the Border Countries and the more turbulent of the tribes controlled by the North-West Frontier Province, and of our Military Relations with them in the Past.* By Colonel H. C. Wylly, C.B. With an Introduction by Lieut.-General Sir Horace L. Smith-Dorrien, K.C.B., D.S.O., A.D.C.Gen. Demy 8vo. Pp. xx + 505. *Price* 10*s.* 6*d. net.* London: Macmillan and Co., Ltd., 1912.

*Southern England, Coast and Countryside: Kent, Sussex, Hants, The New Forest, The Isle of Wight, Wilts, etc.* The Homeland Reference Books. No. 5. Edited by Prescott Row and Arthur Henry Anderson. Cr. 8vo. Pp. 218. *Price* 1*s. net.* London: The Homeland Association, Ltd., 1912.

*The Indian Scene.* By J. A. Spender. Cr. 8vo. Pp. x + 232. *Price* 3*s.* 6*d. net.* London: Methuen and Co., Ltd., 1912.

*Business Geography.* By J. Hamilton Birrell, M.A. Cr. 8vo. Pp. 208. *Price* 1*s.* 6*d. net.* London: Ralph Holland and Co., 1912.

*A Book of the Wilderness and Jungle.* Edited by F. G. Aflalo, F.R.G.S. Illustrated in Colour and Black and White by E. F. Caldwell. Demy 8vo. Pp. 443. *Price* 6*s. net.* London: S. W. Partridge and Co., Ltd., 1912.

*Palæolithic Man and Terramara Settlements in Europe: Being the Munro Lectures in Anthropology and Prehistoric Archæology in connection with the University of Edinburgh, delivered during February and March* 1912. By Robert Munro, M.A., M.D., LL.D. With 75 Plates and 174 Figures in the Text. Royal 8vo. Pp. xxi + 507. *Price* 16*s. net.* Edinburgh: Oliver and Boyd, 1912.

*Arabic Spain: Sidelights on her History and Art.* By Bernhard and Ellen M. Whishaw. With Illustrations. Demy 8vo. Pp. xv + 421. *Price* 10*s.* 6*d. net.* London: Smith, Elder and Co., 1912.

*In Abor Jungles: Being an Account of the Abor Expedition, the Mishmi Mission, and the Miri Mission.* By Angus Hamilton. With Illustrations and a Map. Demy 8vo. Pp. 352. *Price* 18*s. net.* London: Eveleigh Nash, 1912.

*Voyages and Wanderings in Far-off Seas and Lands.* By J. Inches Thomson. Illustrated. Cr. 8vo. Pp. 191. *Price* 3*s.* 6*d. net.* London: Headley Brothers, 1912.

*La Géographie Humaine.* Par Jean Brunhes. Avec 272 Gravures et Cartes. Demy 8vo. Pp. xvi + 802. *Prix* 20 *fr.* Paris: Felix Alcan, 1911.

*Travels in Australasia.* By Wandandian. Demy 8vo. Pp. 413. *Price* 5*s. net.* Birmingham: Cornish Brothers, Ltd., 1912.

*Voyage en Dalmatie, Bosnie-Herzégovine et Monténégro.* Par Pierre Marge. Un Volume in-16. Pp. x + 373. *Prix* 3 *fr.* 50. Paris: Plon-Nourrit et Cie, 1912.

*Maps: How they are made; How to read them.* By H. N. Dickson, M.A., D.Sc., Oxon. Cr. 8vo. Pp. 66. *Price* 6*d.* London: G. W. Bacon and Co., 1912.

*South African Geology.* By E. H. L. Schwarz. Cr. 8vo. Pp. viii + 200. *Price* 3*s.* 6*d. net.* London: Blackie and Son, 1912.

*The Cities of Lombardy.* By Edward Hutton. With 12 Illustrations in Colour, by Maxwell Armfield, and 12 other Illustrations. Cr. 8vo. Pp. ix + 322. *Price* 6*s.* London: Methuen and Co., Ltd., 1912.

*The Edinburgh University Calendar*, 1912-1913. *Price* 3*s. net.* Edinburgh, 1912.

*Official Year-Book of the Commonwealth of Australia*, 1910-1911. By G. H. Knibbs, C.M.G. Melbourne, 1912.

*Some Results of the International Ocean Researches.* By Dr. Johan Hjort. *Price* 1*s.* Edinburgh: The Scottish Oceanographical Laboratory, 1908.

*The Oceanographical Institute at Paris.* By WILLIAM S. BRUCE, LL.D., F.R.S.E. With Illustrations. Edinburgh, 1911.

*Über die Fortsetzung des Antarktischen Festlandes zwischen Enderbyland, Coatsland und Grahamland sowie das Vorhandensein von Neu Südgrönland.* Von Dr. WILLIAM S. BRUCE. Edinburgh: The Scottish Oceanographical Laboratory, 1910.

*Argentine Republic: Information for Intending Settlers from the United Kingdom.* London: H. and W. Nelson, Ltd., 1912.

*The Geology of the Districts of Braemar, Ballater, and Glen Clova.* (Explanation of Sheet 65.) Memoirs of the Geological Survey, Scotland. By GEORGE BARROW, F.G.S., and E. H. CUNNINGHAM CRAIG, B.A., F.G.S. With Contributions by L. W. HINXMAN, B.A., F.R.S.E. *Price* 2*s.* 6*d.* Edinburgh, 1912.

*Official Year Book of New South Wales*, 1911. By J. B. TRIVETT. Sydney, 1912.

*Visual Geography: A Practical Pictorial Method of Teaching Introductory Geography.* By AGNES NIGHTINGALE. 4to. Pp. 48. *Price* 6*d.* London: A. and C. Black, 1912.

*Diplomatic and Consular Reports:—*

Trade, etc., of Curaçoa, 1911 (4956); Trade of Kerman, 1911-12 (4986); Trade of Milan, 1911 (4988); Trade, etc., Marseilles, 1911 (4989); Trade, etc., of Bavaria, 1911 (4990); Trade of Khorasan, 1911-12 (4991); Trade of Bohemia 1911 (4992); Foreign trade of Austria-Hungary, 1911 (4993); Trade of the Island of Formosa, 1911 (4996); Trade, etc., of the Philippine, 1911 (4997); Trade of Kermanshah, 1912 (4994); Trade of Malaga, 1911 (4995); Trade of Leghorn, 1911 (4998); Trade of Gambela, 1911 (5000); Trade of Canton, 1911 (5002); Trade of Baghdad, 1911 (4999); Economic Development of France in 1910 and 1911 (5001); Trade of Casablanca, 1910-11 (5003); Trade of Russia and Moscow, 1911 (5004); Trade, etc., of Brindisi, 1911 (5005); Trade of Tangier, 1911 (5006).

*Colonial Reports—Annual:—*

The Surveys of British Africa, Ceylon, Cyprus, Fiji, Jamaica, Trinidad, British Honduras (730).

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GEOLOGICAL SURVEY OF SCOTLAND.—The following publication was issued from 1st to 31st August 1912 :—

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**ADMIRALTY CHART, SCOTLAND.**—Approaches to Loch Broom and Little Loch Broom. Scale 1 : 29,080. New Edition, 1912. Number 2500. Price 3s.
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**SCOTLAND.**—Bartholomew's "Half-inch to Mile Map." Sheet 21, Inverness and Spey. 1912. Price each sheet, 1s. 6d. paper ; 2s. cloth.
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(*Presented by General J. de Schokalsky, Hon. Corr. Memb. R.S.G.S.*)

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*Department of the Interior, Ottawa.*

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# THE SCOTTISH GEOGRAPHICAL MAGAZINE.

## THE AGRICULTURAL POTENTIALITIES OF TROPICAL LANDS.

The increasing utilisation of steppe lands in temperate and cold temperate regions, alike in the Old and the New Worlds, for the production of human food, is a phenomenon of such striking importance that the other problem, that of the extent to which as yet unused or little-used tropical regions may be employed to yield food for the dense population of manufacturing regions, is apt to be neglected in comparison. It is nevertheless a subject of great geographical interest. As is now well known, the sugar-cane industry, largely though far from entirely a tropical one, is showing signs of recovering the ground which it lost with such rapidity at first under the competition of sugar-beet. Apart from sugar, however, the exports of tropical countries are meantime at least chiefly luxuries, and further are articles in regard to which competition from temperate climates is not to be feared. Will this always be so, or is it possible that food products from the tropics may some day enter on a large scale into the world's commerce in competition with those from temperate regions? The problem is one of much importance, as we have said, and in view of the fact that meantime agriculture in temperate regions has reached a higher degree of development than in the tropics, it seems at least certain that tropical agriculture in the immediate future can only develop under the guidance of races from cooler climates. Tropical planters at the present day are not few in number. Have they reached as yet any general conclusions as to the comparative value of tropical lands?

In two recent numbers of the *Geographische Zeitschrift* Professor Karl Sapper discusses the agricultural potentialities of the tropics. He has, he says, had considerable experience as a planter in various parts, especially in Central America, and also in the Antilles, Bismarck Archipelago, Java, Ceylon, and a part of South India. On the basis

of his own experience he discusses first the question of the extent to which the capabilities of a particular tropical region can be gauged in advance. As he points out, the English and the Dutch have endeavoured to attack the problem practically, by the establishment of experimental gardens in various parts of the tropics, these gardens yielding results of great importance to the planter. In Central America this has not been done, and the planters have to experiment themselves, and take advantage of the various sources of information open to them. Professor Sapper points out that in such regions, if native cultivation is carried on, the opinion of the natives is of considerable practical value, and within limits they can estimate with considerable exactness the possibilities of unused land in relation to their own crops. Where, however, it is proposed to introduce crops unknown to them their opinion is naturally of little value, though they can generally make certain broad deductions as to temperature, rainfall, etc., from the presence or absence of certain plants, which they take as guides.

In the absence of native guidance, the planter must avail himself of such scientific information as is to hand, especially in regard to the elevation above sea-level of the region under consideration, its general climatic features, the nature of the existing vegetation, and, where this is obtainable, the general characters of the soil. Among these facts the nature of the existing vegetation is of great importance, but owing to the great differences in the plants present in tropical regions with similar climates in different parts of the world the subject must be considered along broad general lines, and not from the botanical standpoint.

Professor Sapper considers that from the standpoint of the planter there are only two important tropical plant formations, these being the tropical rain-forest, and the more open lands, under which heading he includes the tropical savanna as well as the savanna-forest. He then proceeds to consider the regions where these two types prevail in some detail.

(1) *The Tropical Rain-forest.*—As has often been pointed out, this demands for its full development rain throughout the year and a high mean temperature. As rainfall diminishes, therefore, the rain-forest thins out, and similarly as temperature diminishes with elevation on mountain slopes it again thins out to savanna. The great luxuriance of vegetation in the rain-forest leads to the common but quite mistaken notion that regions clothed with this formation should yield abundant food for man and beast. In point of fact the appearance of luxuriance is due to the great development of leaves and vegetative organs generally, and is no evidence of rich soil. Useful food products are very few. The sago of the sago palm of Melanesia, and the oily nuts of the palm *Attalea cohuna* in Central America are the chief edible products of the rain-forest so far as plants go, and it is noticeable that wild mammals are generally rare, except where human settlements, with a fringe of cultivated plants, give increased possibilities of food. Under natural conditions, then, the forest yields relatively little food.

To the planter it further offers many deceptions. To begin with,

the process of clearing is laborious in the extreme. In the first place the great development of lianes makes it very difficult to cut down the trees, for even if a particular trunk be sawn through the ropes and cables of living tissue with which it is surrounded may keep it upright. Again, many of the tropical trees put out supporting roots, which come off high up the tree and make the sawing process difficult. After the trees have been cut down it is necessary to get rid of the brushwood by burning, which may be a difficult matter on account of the continuous damp, and even after the burning process the stumps and roots remain. If the land is to be ploughed in the European fashion these must be got rid of by means of dynamite, a slow and costly process which according to Professor Sapper only rarely justifies its expense. He points out that the Indians of Central America in making new fields in cleared land content themselves with digging a hole in the soft ashes with a pointed stick, and dropping a grain of maize therein. Similarly the South Sea Islanders insert a piece of taro rootstock in a hole in cleared land, pile the earth up over the root, and slightly loosen the earth around. Though regarded as highly primitive, these methods are perhaps the best for land which cannot be kept permanently under cultivation, and they have the advantage of being speedy. Professor Sapper believes that some notable failures of European settlement in tropical lands have been due to the attempt to clear the land at once sufficiently for ploughing, which involves a long delay before it becomes productive, while the ultimate result may not give any return for the capital necessarily invested in the clearing process. On a slope ploughing in the rainy parts of the tropics may be very injurious owing to the way in which the loosened earth is washed away; under these circumstances the advantages of the native method are great.

While the difficulty of clearing the surface is a great disadvantage in the case of the rain-forest regions, it has to be remembered on the other hand that the moisture and high temperature lead to very rapid weathering, so that the soil is usually deep. On the other hand, if the rock is devoid of quartz particles the rapid chemical weathering and disintegration may lead to the production of an impermeable clay, with the result that almost useless swamps form.

Except where limestone occurs the planter in the rain-forest area has little concern about water, but the consequent rapid growth of his plants is counterbalanced by the equally rapid growth of weeds, and by the attacks of the wild animals which swarm about his plantations. Further, in many cases the almost constant damp makes the harvesting of the product a difficulty, and artificial drying may have to be resorted to.

If agriculture in the rain-forest is difficult, the pastoral industry is almost impossible. Pasture land can only be produced by the same laborious process of clearing which is necessary for agricultural land, and even if this be done, and a good turf established, the fact that the meadow is surrounded by the forest means that seeds of trees and bushes reach it from all sides, and it rapidly reverts to the original forest condition.

Among the advantages of the forest are to be mentioned the abundant supply of material for building and roofing houses, bridge construction, and so forth, and the absence of dust in the air which is favourable to those suffering from lung disease, while the abundant water makes digestive disturbances less frequent than in the savanna. On the whole, however, the conditions are unfavourable to the preservation of health and energy. Communications are also difficult, except by water. The wood paths are never quite dry, and with heavy traffic become impassable, while the maintenance of railway lines and telegraph wires is a matter of great difficulty, owing to the rapid decay of poles and sleepers, the loosening of embankments by the fast-growing tropical plants, and so forth.

On the whole then the forest is unfavourable to agriculture and dense settlement. The most favourable conditions are found where the forest land abuts either upon a prosperous coastal region or upon a savanna region which is already in a high state of cultivation. From such vantage points cultivation may be pushed into the forest, but large areas of it seem meantime destined to remain almost uninhabited.

Its natural products, however, are far from negligible. In addition to those already known, others doubtless remain to be discovered or utilised. Thus recently the widely-spread mangrove is beginning to acquire economic importance because its bark can be used as a source of tannin. It is being so utilised in Madagascar and German West Africa, while in the Kamerun it is useless, both because of the smaller tannin content and because the continual damp makes it impossible to dry the bark. Even with regard to the natural products, however, many difficulties prevent the development of trade on the scale in which it occurs in the temperate forests. The difficulties of communication again bulk largely, and it is noted that some of the valuable tropical woods do not float in water, which enormously increases the difficulties of transport. On the whole also, in spite of their frequent beauty, the tropical timbers cannot compete with the temperate ones. They are often difficult to work, and there is nothing to represent the great development of straight-stemmed conifers in the northern forests. Among the curious little illustrations which Professor Sapper gives of the slight commercial value of the rain-forest is the fact that in the construction of a saw-mill in the primitive forest region of the Motagua valley, in Guatemala, it was found necessary to import North American pitch pine for the woodwork, because the tropical timbers, owing to their poverty in resin, rot too quickly.

As to the plants which can be grown in the region of the rain-forest, the author remarks that the salt-containing soil where mangroves grow is almost useless, though cocoanut palms will stand a small percentage of salt. Swamp lands are also nearly useless, though the sago palm, the cocoa tree, and Castilloa rubber will tolerate occasional immersion. Among plants suitable for other parts of the region, and yielding products for export, are coffee, quinine, spices, tea, tropical fruits, especially the banana; somewhat less suitable, on account of the excessive moisture, are sugar cane, cotton, and tobacco. All these must be grown on perman-

ently cleared ground, and being produced for export are liable to great fluctuations in price. For his daily food the cultivator must depend upon such plants as yams, taro, manioc, millet, maize, and so forth. These can be grown native fashion on temporarily cleared ground, and of them maize is the most adaptable so far as climatic conditions go. Rice, a crop produced only with great labour, is a plant which can only be grown where the population is dense, and the land is permanently under cultivation.

Professor Sapper gives it as his opinion that the more elevated ground, that above 1500-2000 metres (5000-6500 feet), will never yield very profitable crops. At such elevations tropical plants cease to thrive, and the constant cloud and heavy rainfall make even temperate plants unprofitable. It is possible, however, that these lands may support a pastoral industry, as tree growth is not so vigorous as at the lower levels.

(2) *The Savanna Lands.*—The most important climatic condition for the rain-forest is the absence of a well-defined dry season. So soon as this appears, as in travelling towards the interior of a region, or in crossing a range facing the rain-bearing winds, or in travelling away from equatorial regions to the north or south, the vegetation instantly responds. Except where the vicinity of watercourses, or some similar condition, makes the soil permanently moist, the response is twofold. In the first place, the trees lose their leaves in the dry season, or show some other adaptation to the periodical drought, and there is thus a well-marked periodicity of plant growth. Second, the trees no longer form a continuous stand, but gaps and natural clearings appear which permit the drying winds of the dry season to penetrate. With the increasing length of the dry period, trees, as is well known, diminish in number, take on special characters, and gradually the rain-forest is replaced by open savanna or desert.

From the human standpoint the region with a periodic dry season has many advantages over the rain-forest belt. The land is more easily cleared, not only because the growth is thinner, but because the dry season facilitates the process. Fire can also be more easily employed as the clearing agent: indeed in many cases special care has to be taken to prevent excessive destruction by spontaneous or artificially kindled wood fires. Further, during the dry season the land can be more easily prepared for crops than in the rain-forest area where growth is continuous. Difficulties in connection with gathering, drying, and storing the crops also are less than in the damper areas, and finally, health and energy are more easily maintained. In consequence in Central America it was the dry, open lands which were most thickly peopled before the Spanish conquest, and in tropical America generally the Spaniards established themselves in these open lands, which resembled the lands of their home, in preference to the regions of more luxuriant growth. It was not by accident, also, that the capitals of the tropical American States were established in the dry interior at a considerable elevation, rather than in the damper and lower regions.

Disadvantages are not, however, wanting. Chemical weathering is

less active than mechanical, and the soil is therefore sometimes poor; the soil is also less protected by vegetation from being washed away, and therefore is not so deep as in the rain-forest. In consequence of this occasional poverty of the soil, it is the custom in Central America not to bring land under the plough unless it bears under natural conditions angiospermous trees or bushes; tracts bearing only grasses and conifers are regarded as too poor for cultivation, though to this statement there are exceptions. These grassy tracts, however, will often serve as natural pastures, though they are improved by the introduction of grasses of higher feeding value than the indigenous ones. But Professor Sapper does not believe that the pastoral industry will ever be so profitable in tropical as in temperate lands.

Among the various types of land to be found in the open belts, the following may be mentioned. Regions with a long dry period tend to be clothed naturally with a thorny scrub, and are adapted only for short-lived crops which make their growth during the rainy season, and are harvested with the onset of the drought. On the other hand, hollows floored with clay become fever-haunted swamps during the wet season, and can only be utilised during the dry season, when they yield a scanty pasture. The most favourable areas are the fertile belts which can be irrigated during the dry season. Here cropping can be carried on continuously throughout the year, if fertilisers are applied in sufficient quantity. In Central America it is asserted that three crops of maize can be taken off the same plot, though Professor Sapper states that he has never seen more than two actually obtained. Among the other plants for which such irrigated ground is suitable are rice, sugar cane, tobacco, cotton. Plants demanding less moisture are indigo, henequen, the cochineal-cactus, coca. In the higher and cooler regions maize, beans, Mexican agave, European cereals, vegetables and fruit all thrive. These higher regions, up to about 3200 metres (10,500 feet), Professor Sapper regards as climatically the most suitable parts of the tropics for Europeans, but, in Central America at least, they are very generally densely peopled by natives, so that there is little free land. Even where this is obtainable he gives it as his opinion that the European cannot compete in the open market with the native-born, for the advantage gained by European methods and machinery is not sufficient to counterbalance the fact that the demands of the European are greater than those of the native, and the latter can thus easily undersell him. The productiveness of the land here, as in the tropics generally, is, he believes, greatly overrated, and at the higher levels the vegetative season is very long. In Guatemala, near the upper limit for maize and European cereals, it reaches ten months, and there is always the risk of frost.

As compared with the rain-forest region the savanna lands yield few natural products of any value, and though communication by land is less difficult than in the rain-forest, in the dry season water communication is greatly impeded or even rendered impossible.

*General Conclusions.*—In summing up his conclusions on the relative value of the chief types of tropical lands, Professor Sapper refers chiefly to tropical America, and lays stress on the Spanish-American division into

Terra Fria, the high lands regularly liable to frost, the frost-free Terra Templada, and the hot Terra Caliente of the lowest level. In the Terra Fria, whose lower margin lies in Guatemala at about 1800 metres (6000 feet), tropical plants are excluded, except in the case of those showing great thermic adaptability. Maize, beans and the crops of temperate latitudes are the chief plants grown, but it is noticeable that the conditions are less favourable than in temperate lands generally. The days are permanently short, the long summer days of high latitudes being absent. Mist often hangs almost perpetually about the slopes, so that the plants suffer from a want of sun, and generally the productivity is less than in temperate regions. On the other hand, health conditions are good, and the population often fairly dense, so that the Terra Fria serves as a reservoir of labour upon which the lower lands may draw.

For Europeans the Terra Templada is climatically less favourable, but the produce has not to fear the competition of the better organised temperate agriculture. To an even greater extent both statements apply to the Terra Caliente. In both it would seem that only land bearing arborescent vegetation is fit for the plough, the grass-lands are suited for cattle, the rain-forest area for plantations of rain loving trees and shrubs, the region of lighter wood and scrub for drought-tolerating tropical plants, and so on.

As to the value of the product to be obtained from tropical agriculture, even under favourable circumstances, the author points out that an element of great uncertainty enters into all calculations. A very profitable branch may suddenly have its value enormously reduced as the result of competition with a natural (*e.g.* beet sugar) or an artificial (*e.g.* synthetic indigo) temperate product: political and economic conditions are also usually unstable, while the risks of animal or vegetable parasitic attack are as great as in temperate zones. Generally, the more limited the crops grown in a particular region, the greater the risks.

The paper concludes with a comparison between the conditions which prevail in Java, with its dense population, and Central America with its scanty one. The author regards the difference as largely the result of the different methods of colonisation employed by the Dutch and the Spaniards, and points out that while in Java the result of European interference has been the replacement of rain-forest in some regions by cultivated land, in Central America to-day the forest has a greater extension than at the time of the conquest. He regards the Dutch method of preserving racial purity, that is keeping up a purely European administrative body, as better than the Spanish method of severing European ties to as large an extent as possible. In the first case, he says, the connection with Europe has led to continuous scientific supervision of Javan agriculture, while in Central America advance has only been made within the last fifty years or so, under the influence of a recent influx of Europeans. This position of course implies that the tropics can only be expected to develop under the guidance of and for the benefit of alien races from temperate climates. This view, however, is not definitely stated, nor does Professor Sapper discuss the interesting question of whether the new race produced in tropical America by

intermingling is likely itself to build up a stable civilisation without European intervention, that is, whether it may not evolve an agriculture of its own.

The paper is interesting as tending to correct common errors as to the great fertility of tropical lands, and the supposed ease with which tropical agriculture can be carried on. It shows that the untended tropical luxuriance described in *Paul and Virginia* has as little real existence as some other imaginings of the eighteenth century.

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## A GEOGRAPHICAL DESCRIPTION OF EAST LOTHIAN.

By Charles M. Ewing.

### I.—Introduction.

The county of East Lothian, or Haddingtonshire, lies between the parallels of 55° 49′ 8″ and 56° 4′ 44″ north latitude, and between 2° 21′ and 3° 1′ west longitude. It is bounded on the north, the north-west, and again on the north by the Firth of Forth, and on the north-east by the North Sea. On the south-east and south it is adjoined by the county of Berwickshire, and on the south-west and west by that of Midlothian. It has a coastline of 31¾ miles in length, 16½ of which are washed by the North Sea, while its land boundaries, determined for the most part by no natural features, are 29 miles long. Its utmost length is 26 miles, its utmost breadth 19 miles, and its area, according to the agricultural returns for 1910, 171,389 acres, or 267·7 square miles, of which some 90 are occupied by the Lammermuir upland. Its nearest point to Fifeshire—the Longskelly Rocks in Dirleton parish—is 8⅕ miles from Elie Ness, but the Bass Rock is only 7¾ miles distant from the Isle of May, a part of Fifeshire. Several islands in the Firth belong to East Lothian, of which only the Bass Rock, Fidra, Lamb, and Craigleith are of any size.

### II.—Coastline.[1]

The coastline of East Lothian is, on the whole, fairly regular, possessing few natural harbours, and is unsuited for shipping on a large scale. Only two indentations of any size diversify it—Aberlady Bay, and the estuary of the Tyne—and these are only deep enough for the smallest craft.

From the western limit of the county to Port Seton there is scarcely a break in the long line of habitations and places of industry that border the shore. As far as Prestonpans the coast, running north-east and south-west, consists of a steeply shelving, muddy or stony shore, backed by a low, grassy bank twenty or thirty feet high. Off Prestonpans lie some rocky patches, called the Heckles, which give trouble to coasting vessels. East of the latter a low and more sandy shore, with a considerable acreage of sandy waste behind, extends all the way to Aberlady, between which and Port

[1] Chief authority: *North Sea Pilot.*

Seton the population is particularly scanty. Beyond this point the coast, running almost due north and south, consists almost entirely of sand-dunes culminating in Gullane Hill. At Eyebroughy Point, where "foul ground" extending a mile to seaward is dangerous for navigation, it assumes an east and west direction, and is mainly low and sandy as far as the fashionable resort of North Berwick, adjoining the northern slope of the prominent Law.

The seaboard here is fringed by several rocky islets: Fidra with its excellent revolving light, visible 17 miles distant, is only just seagirt at low water; Lamb Isle is connected with the mainland by a nest of sunken rocks; Craigleith is separated from the coast by half a mile of navigable water; and the precipitous Bass Rock (1¼ miles off shore), the largest of them all, with a circumference of nearly a mile, has a depth of fifteen fathoms all round.

Eastward of North Berwick the coast becomes steep, broken, and rocky, the formerly almost impregnable Tantallon Castle, the old stronghold of the Douglases, being built on huge cliffs of volcanic origin. Shipping is here rendered difficult by a number of far-protruding ledges and sunken rocks.

At Seacliff the coastline bends round to the south-east, a direction which it maintains—with some slight variations—to the Berwickshire border. Rugged at first—especially at the dangerous Scoughall Rocks—the coast gradually becomes gentler, and an extensive stretch of sand occurs at the mouth of the Peffer. Near the Scoughall Rocks a considerable expanse of shore is traversed by scars arranged in horse-shoe form, the remains of the elongated dome-shaped anticlines into which the strata were here bent.

To the south-east of the low, sandy estuary of the Tyne, relieved only by the low and treacherous Wildfire Rocks of St. Baldred's Cradle, is the rugged and broken volcanic seaboard of Dunbar—a district rich in reefs and sunken rocks. For some miles south of Dunbar the seaboard is low and rocky, and off Vault Ness there are several dangerous shoals. On Barness, a low promontory with a considerable extent of "foul ground" in front of it, a lighthouse, recently built, marks the spot of many shipping disasters. From here to the Berwickshire border the coast gradually rises, its steep slopes being fully a hundred feet high to the north of Bilsdean: there is but one well-marked indentation—the little haven of Skateraw, which is sometimes more accessible to small vessels in stormy weather than Dunbar.

## III.—Relief.

The chief subdivisions of the county are the Lammermuir hill area—part of the southern uplands—and the lowlands to the north, the south-eastern portion of the great Scottish rift valley.

The Lammermuirs are sharply divided from the lowlands to the north-west by a great fault running from south-west to north-east, and again from the plains bordering the North Sea by another fault from north-west to south-east. They are steepest along their north-west and north-east edges, and slope gradually down to the Merse lowlands

of Berwickshire in the south-east. When viewed from their base on the north-west, they have all the appearance of a definite range of hills, but one has only to surmount them here to find that they consist of a plateau —highly dissected in parts, it is true—whose summits are merely the highest parts of its undulating relief. Thus Meikle Says Law (1749 feet), the greatest altitude attained by the range, is but the highest part of a tableland almost exactly $5\frac{1}{2}$ square miles in area, which never descends below 1500 feet. Again to the east of the Whiteadder, while the average height of the central tableland is over 1000 feet, and the summits reaching 1100 feet are quite numerous, the highest point—Clints Dod—attains but 1307 feet. It is interesting to note that only at one point can the main range be completely traversed from north to south without ascending to the 1000-foot contour, viz. just to the west of Bransly Hill. Lammer Law (1733 feet) is the nearest approach to a hill proper in the range, but it too is only a portion of the plateau more isolated by weathering.

To the north-east of the Lammermuir area is the coastal strip bounded on the north by the Whittinghame Water. In the vicinity of Dunbar this is a fine level tract, three to four miles broad, but further south it gradually tapers off until south of Thorntonloch the 100-foot contour reaches the coast, and just over the Berwickshire border spurs of the Lammermuirs come down to the water's edge. North-west of the Lammermuirs extends the lowland area occupied by the Tyne valley; it can, however, only be called a plain in the neighbourhood of Haddington itself and downstream of East Linton, for it includes all that undulating country which adjoins the north-west base of the Lammermuirs, while in the area south of East Linton rises the prominent height of Traprain or Dunpender Law (704 feet). A line of uplands, culminating in the Garleton Hills (590 feet), and extending in a west-south-westerly direction from near East Linton to the Macmerry Railway in the west, bounds the Tyne basin to the north. Beyond this railway the line is continued by the high country (300 to 400 feet), which gradually bends round to the south and merges into the Roman Camp uplands of Midlothian.

The rest of the county, lying to the north of this line of heights, forms the last natural subdivision. The southmost strip of this, extending from the western border to East Linton, where it merges into the Tyne valley subdivision, is relieved only by inconsiderable undulations; but, further north, Gullane Hill and the upland to the east of the North Berwick railway both reach 200 feet, while the volcanic cone of North Berwick Law is 612 feet high, the cliffs of Tantallon rise to over 100 feet sheer out of the sea, and, across a strait $1\frac{1}{4}$ miles wide, the Bass Rock attains a height of 350 feet.

## IV.—Hydrography.[1]

On the whole, the rivers of the Lammermuir watershed flow either in a north-easterly or a north-westerly direction, the latter being the

[1] Authorities: *Geological Memoir: The Geology of East Lothian*; Kendall and Bailey, *Glaciation of East Lothian* (*Trans. Roy. Soc. Edin.*).

consequents, the former the subsequents. South of this watershed, the consequent waters flow south-east. The chief river of East Lothian is the Tyne, north of which there is a remarkable absence of running water. South of the Tyne is a belt some six miles wide, stretching from the upper Tyne valley in the west to the Tyne estuary on the east, which is watered by the tributaries of the Tyne and the Whittinghame Water. South of the latter is another belt, about five miles wide, which is drained by numerous parallel streams flowing into the North Sea. South of the Lammermuir watershed, the district is watered by various branches of the Whiteadder and the Leader, which both eventually flow into the Tweed.

All the more important streams take their rise in the Lammermuir upland or in its western continuation. Not only is this the rainiest portion of the county, but the Silurian rock of which it is composed is very impervious,[1] with the result that the water runs off it in the form of rivers. It is, too, the main watershed of the county. Here the stronger south-flowing rivers are gradually pushing the divide northwards at the expense of the tributaries of the Tyne and Whittinghame Water. The former, in fact, rise within two miles of the north-west edge of the Lammermuirs, of which some of the chief summits, though close to this edge, lie actually to the south of the watershed. While, however, the drainage area of the Tweed tributaries is growing northwards, it is diminishing eastwards, where the east coast streams threaten to capture their eastmost headwaters.

The river Tyne itself is only twenty-three miles long, and flows for the first seven miles of its course through Midlothian. It rises in Middleton Moor at a height of 800 feet. The north and south Middleton Burns, finally captured by the Gore Water, a tributary of the Esk, seem to have originally formed the headwaters of the Tyne. Just to the south of Crichton Castle[2] its comparatively small valley is joined by a wide, but dry valley descending from the south-west, through which it thereafter pursues its course in a north-easterly direction as far as Ormiston. The explanation of this appears to be as follows: At the time of the retreat of the ice-sheet, streams descending from the hills came against the great ice wall to the north, and, failing to surmount it, were diverted along its margin for long distances. The Tyne here occupies a channel formed in this way, the size of which is probably accounted for by the fact that it drained a part of the Moorfoots, as well as the Lammermuirs.

At Ormiston the Tyne bends round and becomes a true subsequent stream for the rest of its course. Just here there is a gap in the uplands to the north-north-east exactly in line with the direction of the river to this point. The bed of the Tyne at Ormiston is not less than 260 feet high, and the summit of the gap—on either side of which are well-marked heights of upwards of 400 feet—is only 290 feet. Moreover, there are

[1] *Geological Memoir* (Water Supply).

[2] See J. Cossar's *Notes on the Geography of the Edinburgh District* (*S.G.M.*, vol. xxvii. (1911), p. 598).

faint traces of a deserted channel to the west of Macmerry, and the gorge north of Seton Mains seems capable of carrying a considerable stream. The suggestion, therefore, is tempting that the waters of the upper Tyne valley at one time flowed through this gap, and following much the same course as the present little Seton Burn, so reached the Firth of Forth.

About two miles east of Pencaitland the Tyne enters what may be described as a torpedo-shaped plain. Through this it meanders as far as the county town, in the widest part of the plain, where not infrequently considerable flooding occurs. About two and a half miles north-east of Haddington, at Beanston, there is a noticeable gap in the upland to the north. So thick is the boulder clay here that borings have failed to reach its base, and a great depth of this soil appears to continue right over to the east Peffer Burn. A theory [1] has therefore been advanced that in pre-glacial times the Tyne flowed through this gap and reached the sea by way of the present Peffer Burn channel. Certainly the narrowness of the Tyne valley, just above East Linton, where it does not appear to be old, seems to justify this theory ; but, on the other hand, the present exit of the river to the sea is too well matured to be solely the work of comparatively recent ages. Below its fall at East Linton, the Tyne becomes a sluggish stream, aggrading rather than degrading, and enters the sea by a wide, sandy estuary.

It is interesting to note that the river receives not a single left-bank tributary of any consequence downstream of Ormiston. For almost the entire volume of the Tyne, therefore, the southern uplands are responsible. Here its two chief tributaries, the Birns Water and the Gifford Water, rise. The first noteworthy fact about the former is that its subsequent tributary, the Keith Water, is much larger than the consequent main stream above their confluence. As a matter of fact, the Keith Water makes use of an old " marginal " channel cut by a stream that ran along the front of the great ice-sheet, and taps the little consequent streams coming down from the hills for a considerable distance to the west.

An interesting capture [2] was effected by the Linn Dean Burn, a tributary of the Keith Water, in the glacial epoch. Prior to this, the headwaters of the Linn Dean Burn, rising in Blegbie Hill, flowed south-west into the Armet Water, but in glacial times the whole of the valley of this latter became blocked up by a glacier which advanced as far east as the present Linn Dean, and ponded up the waters coming down from Blegbie Hill. As their passage to the south-west was barred, they were compelled to dig out a channel to the north, viz. through the Linn Dean, and so well-defined had this become by the time glacial conditions had passed away, that they continued ever after to make use of it.

A similar phenomenon [2] may be seen near the source of the Gifford Water. Formerly the Blinkbonny Burn seems to have flowed into the Harelaw Burn, but a local glacier, filling up the valley of the latter, so ponded up the waters of the former that they were compelled to seek

[1] *Geological Memoir*, p. 171. [2] Kendall and Bailey.

escape by carving out a new channel to the north, which they still occupy.

Again, just to the north of the neighbouring Sting Back Burn, the hill is cut by a well-marked north-and south dry valley. Evidently the area now occupied by the tributaries of the Sting Back to the south was at one time blocked by a glacier, which thus gave rise to an ice-dammed lake: the overflow waters of this lake carved out an outlet for themselves to the north which was, however, abandoned on the disappearance of glacial conditions.

Again in the case of the Gifford Water the subsequent tributaries, which have cut out channels for considerable distances to the south-west, are distinctly longer than the little consequents which stop short almost as soon as they reach the hills proper. Here, indeed, the shrinkage of the Tyne drainage area in favour of the southward-flowing tributaries of the Tweed is especially evident.

Originally the consequent tributaries of the Whittinghame Water, the Parana, the Thorter, and the upper reach of the Sauchil Water, in all probability flowed north-west into the Tyne. During the retreat of the ice-sheet, however, a marginal drainage channel was formed by means of which the waters of these streams were thereafter conveyed into the sea at Belhaven Bay. The anomalous direction taken by the Whittinghame Water, as far as its confluence with the Sauchil, is accounted for by the glacial origin of its channel.

To the south of the Whittinghame Water are four consequent streams flowing north-east from the Lammermuirs to the North Sea, viz. the Spott Burn, the Dry Burn, the Braidwood Burn, and the Dunglass Burn. They must, of course, be termed consequents because, though they run parallel with the subsequent lower course of the Tyne, the main drainage slope in this part of the country is from south-west to north-east. At the same time, it must be added that long stretches of their courses were utilised, if not entirely formed, by glacial drainage streams.

The basin of the Spott Burn [1] is especially interesting in relation to the ice age. The channel occupied by the artificial Pressmennan Loch runs parallel to the contours, and quite high up the north slope of Deuchrie Dodd. Without the interference of ice it is inconceivable that any stream could have cut such a channel. In making the loch the engineers had to dam up its upper as well as its lower end, so gentle was the gradient. The same gentleness of gradient may be noticed in the dry valley between Kidlaw and Gifford, which indeed resembles the course of a winding canal rather than of a river, and, as Professor Kendall remarks, must be explained by the fact that these channels were at certain intervals called upon to carry away large volumes of water which were able to maintain a current even after they had degraded their beds to the local base-level.

A few hundred yards west of Spott village the Spott Burn valley is joined by a dry valley on the left, the bottom of which is very nearly on a level with the stream itself. Both valleys are of very considerable

[1] Kendall and Bailey.

size, and were clearly excavated by a much larger river than the little Spott Burn: on inspection we find that the outer walls of the dry valley are much more steeply cut than the inner, and that the stream forming these must have been "accurately proportioned to the size of the valley." We conclude, therefore, that the present Spott Burn is a typical example of a "misfit," that its valley was cut by some larger river, which can only be satisfactorily explained as a marginal glacier stream, and that the Spott Burn has since the Ice Age been incapable of vertical erosion.[1]

In the south-east section of Haddingtonshire an important part in the drainage system is played by what are called corroms. One effect of the strong-flowing glacial drainage streams was to wear down, and sometimes entirely demolish, the earlier watersheds. Later, when these marginal streams carried little or no water, owing to the retreat of the ice-sheet northwards, but when the melting of local glaciers and snow on the uplands was still going on apace, swollen streams laden with much silt poured their contents into these marginal channels, and building large deltas of detritus right across them, thus formed new watersheds, to which the name "corrom" has been given. Thus a tributary of the Spott Burn, the Howe Burn,[2] built out a delta across one of these channels, and forced streams, formerly flowing into the Dry Burn, to travel north into the Spott Burn. At Common House, nearly three miles south-south-west of Spott, several streams meeting have poured forth so much detritus into a similar channel, running at right angles to their direction, that they have actually bridged it over and now flow right across it to the north. But the best example of corrom formation in the district is that afforded by the Aikengall Burn,[2] now running north into the Braidwood Burn. The original watershed, removed doubtless by glacial floods, was in all probability between Needle Hill and Weather Law, and the Aikengall Burn must formerly have been a tributary of the Oldhamstocks Burn. Late in the glacial epoch the stream heaped up a large delta at the entrance to the Sheep-path Glen, which had the effect of diverting its waters northwards. Other streams to the north at the same time also pushed out rival deltas, but the Aikengall always managed to wear them down, and maintain its northward course.

The Braidwood Burn affords an example of a miniature valley within a much larger one. Unlike the Spott Burn, the Braidwood was able, after the great Ice Age, to carry on considerable vertical erosion.

In the valley of the Oldhamstocks Burn, a tributary of the Dunglass Water, are not only well-preserved river terraces, but above them gravel terraces of fluvio-glacial origin.[3] It is to be noted that the incline of the latter is gentler by about fifty feet in one mile than that of the present valley floor, and also that they cease altogether below their confluence with the Berwick Burn. The local base-level must therefore have been much higher then than it is now—a fact probably accounted for by the

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1 Kendall and Bailey; Plate VIII., *Geological Memoir*.

2 Kendall and Bailey; Plate IX., *Geological Memoir*.

3 *Geological Memoir* (Ice Age).

presence of the ice-sheet in the neighbourhood of this confluence when the glacial terraces were formed.

North of the Gladsmuir and Garleton uplands are the east Peffer Burn, which enters the North Sea north of Tynninghame, and several small streams flowing into the Firth of Forth, of which the largest is the west Peffer Burn with its outlet at Aberlady Bay. They offer, however, little of interest to the student of rivers.

## V.—Geological Structure.[1]

The following account makes no pretence of being complete. Only in so far as the physical history of the past enables us to explain the present configuration or the present economic conditions is recourse had to it. From a geological point of view, therefore, an unduly large amount of space is devoted to the great Ice Age, because it has had so important a bearing on the intricate structural detail, and on the quality of the soil of the county.

The Southern Upland part of the county—of Silurian age—is at once the highest and the oldest. Despite the fact that it underwent denudation for ages prior to any other part, it is still essentially the highland area. To the north-west it is bounded by the great and very well-marked Lammermuir fault, to the north-east by the almost as evident Dunbar, Innerwick, and Oldhamstocks fault. The former, indeed, forms the south boundary of the Great Central valley here, and it is highly probable that the vast deposits subsequently laid down in this valley at one time obliterated all distinction between highland and lowland. In East Lothian the only surviving members of these deposits—of Old Red Sandstone and Carboniferous date—are as a rule but little contorted, and in places almost horizontal. They cannot, therefore, have been subjected to any great folding movement, which might have given them strength and endurance, and thus they were readily worn away. The Lammermuirs, on the other hand, must have undergone great pressure, and become folded, crumpled and crushed by great mountain-making movements, and thus their powers of resistance were enormously increased. A superficial observer might fail to notice the vast difference in structure between upland and lowland here, so well hidden are the rocks of the former, but one has only to ascend several of the deep-cut Lammermuir glens to notice the effects of intense folding, in strata dipping almost vertically, anticlines bereft of their tops, and older resting upon younger rocks.

The Lammermuirs are mainly composed of shales, grits, and greywackes of Silurian age; alike in structure and the composition of their rocks they bear a close resemblance to the other rocks of the Southern Uplands, their black shales, abundantly supplied with graptolites, being especially characteristic of this group. The Silurian area is in parts pierced by intrusive masses of granite, the chief of which are Priestlaw and Cocklaw. The former, indeed, illustrates well the hard,

[1] Chief authorities: *Geological Memoir*; Kendall and Bailey, *Glaciation of East Lothian*.

resistant nature of the Lammermuir rock, for stout, unyielding granite that it is, it actually forms a depression here. To the east the Silurian formation was apparently traversed by an important river, which filled its valley with a vast quantity of Old Red Sandstone conglomerate, extending from Spott to the south-east corner of the sheet. This conglomerate is also of a hard, enduring nature, and has maintained the highland nature of the Lammermuirs in the east. Owing to the variety of the ground-mass which binds together its pebbles, it weathers unevenly, and occasionally takes the form of fantastic peaks and pillars, such as occur on the west and south-west of Oldhamstocks.

The lowland area of East Lothian is diversified by a number of isolated hills, which used to form valuable strongholds in time of English invasion. One and all of these are composed of hard igneous rocks which have offered a much stouter resistance to the denuding powers of the elements than the sedimentary formations of Old Red Sandstone or Carboniferous Age. Some are true lava-flows. The majority, however, consist of lava which cooled below the surface, and were at one time concealed beneath a thick covering of sedimentary rocks which only the weathering of centuries has removed.

The most extensive volcanic eminence of the county—the rounded Garleton Hills—is composed of a series of much dissected lava-flows. A number of intrusive sills, however, occurring close at hand, are scarcely to be distinguished in rock character from the Garletons.[1]

The northern part of the county is characterised by a number of prominent "stocks," caused by the consolidation of igneous material in volcanic pipes or ducts, from which many of the surrounding lava-flows probably originated. Such stocks are round or oval in cross-section, and vary greatly in size. The two chief landmarks of north Haddingtonshire—North Berwick Law and the Bass Rock—are stocks on a large scale. Another very prominent one occurs on the coast, just to the north of the Tyne estuary, viz. St. Baldred's Cradle, which was probably the source of much of the lava in the vicinity. The Dove Rock in Dunbar Harbour is a plug of basalt filling up a volcanic neck.

The dome-shaped Traprain Law is a true laccolite, recalling similar formations in the Henry Mountains of North America. Its arched covering of sediment has, of course, long since been stripped away. Craigleith, also, is probably a laccolite. Two of the other islands on the north coast—Fidra and Lamb—are igneous intrusions.

Certain minor features, called into being by volcanic action, may also be briefly alluded to. In the intensely volcanic district of Dunbar there are no fewer than twenty vents, varying in diameter from a few yards to as much as half a mile; the shrinkage of these on cooling is shown by the sudden increase of steepness in the dip of the surrounding rocks. An excellent example of a dyke is seen at Dunbar Castle, while others occur on the coast at Port Seton and Prestonpans, as well as between Dunbar and Belhaven, in the form of skerries. An inclined sill, occurring between Victoria Harbour and Broad Haven, is composed

[1] *Geological Memoir*, p. 53.

of typical columnar basalt, while to the east of North Berwick rocks of columnar structure have been worn into stacks by the action of the sea.

The low-lying parts of Haddingtonshire are formed either of the less resistant igneous rocks to the north of a line joining Cockenzie to Dunbar, or of the soft sandstones and limestones of Old Red Sandstone or Carboniferous Age. The different formations represented here vary little in their power of resisting erosion. Certainly the Lower Limestone group forms a kind of escarpment in the Roman Camp ridge,[1] but for the most part the outcrops of these formations are not distinguished by any undulation of the surface. The presence, however, in glacial deposits of carboniferous masses of all sizes has led some geologists to believe that slight escarpments, obliterated by the enormous power of the ice-sheet, did at one time define these outcrops.[1]

While other ages were responsible for the main relief features of the county, the present configuration owes much of its detail to the great Ice Age.

The existence of boulder clay in all parts of the county makes it certain that the whole area was at one time buried beneath the great *mer de glace*, a fact made abundantly clear also by the smooth, flowing nature of its entire surface. Far away in the western part of the Central Lowlands two great ice-flows met—one from the Highlands and the other from the Southern Uplands—and joining forces proceeded in a generally eastward direction through the Central Valley. Numerous schistose erratic blocks, indeed, especially common in the south-west part of the county but occurring in considerable numbers all along the north-west base of the Lammermuirs, can have come from no other region than the Highlands. Here we have distinct evidence that the stronger Highland flow of ice was gradually pushing that of the Southern Uplands back upon itself, and compelling the whole sea of ice to move in a direction oblique to that of the main Lammermuir trend. Further proof of this tendency to override the Lammermuirs is shown by the fact that numerous coals occur in the boulder clay at Oldhamstocks, evidently transported from the West Haddington coalfield. Again, boulders of the Craigmillar sandstone carried from the vicinity of Edinburgh have been found both at Port Seton and Dunbar.[2] Hence, from this evidence as well as from that afforded by ice-groovings and the somewhat rare ice-scratchings, one is justified in concluding that on entering the county from the west the direction of the ice was east-north-east, but that to the east it became gradually east-south-east. The only difficulty here is that the boulder clay in the Pencaitland neighbourhood contains many pebbles of Silurian greywacke, of which the Southern Uplands are undoubtedly the source. These, however, may have been brought down from the south by a local glacier either prior to, or, more probably, later than the period of maximum glaciation.

When more temperate conditions returned, the great ice-sheet

[1] *Geological Memoir.*

[2] *Geological Memoir* (Ice Age).

retreated gradually towards the north. At first a subsidiary mass of ice capping the uplands poured down small ice-flows to join the great ice-sea to the north. At length a time came when these melted before they could reach the ice-sheet, and swollen torrents rushed down from the hills to meet the great ice-front, where their waters were either ponded up and formed marginal lakes, or helped to dig out "marginal" drainage channels.

Now and then, however, the temporary return of colder conditions would cause a re-advance of the *mer de glace*. Thus beds of sand have been found intercalated with beds of boulder clay, as *e.g.* at the Red Scar in the Upper Keith Valley.[1] The sands in the cases studied seem to have been deposited on lake floors, while the boulder clay has clearly been left behind by the great ice-sheet. The ice must therefore have retired to make the presence of a lake possible, but have returned later and deposited this boulder clay. Again several examples occur where the top of a more northerly overflow channel in a spur is higher than the floor of a more southerly one, clearly showing that the former must have been cut before the latter, and that the existence of the latter can only be accounted for by a re-advance of the ice-sheet. A good example is afforded in Rammer Cleugh, behind Deuchrie Dod. The Rammer Cleugh is a dry valley of considerable size, adjoined to the north by a high-level dry valley. The latter could never have contained a stream at all, had it not been made before Rammer Cleugh itself.[2]

In the last stage of Glacial Epoch, after the great ice-sheet had finally retreated from the district, there was still a vast accumulation of névé on the Lammermuirs, and the melting of this gave rise to many swollen streams which conveyed abundance of detritus to the lower-lying districts, and in many parts built up the peculiar deltas or corroms already mentioned.

The above is a general sketch of the Glacial Epoch; it now remains to describe—as far as possible in chronological order—the more important geographical details called into being in that age.

To the south and east of the county town, the country is diversified by parallel lines of long, low and gently rising ridges with generally an easterly and westerly trend, and in places a well-developed "echelon" arrangement. They are separated by shallow glacial groovings, and, though mainly composed of rock with but a thin coating of boulder clay, they owe their present form to sub-glacial action, and may therefore be called drumlins.[3]

Again, Traprain Law and North Berwick Law both present exceedingly steep faces to the west, while they slope much more gently to the east. The ice-sheet moving in an eastward direction has scoured away all but the rock itself on the west side, but on the east flank it has been able to heap up considerable quantities of drift. This is therefore an example of crag and tail structure.[3]

Nothing, however, illustrates so forcibly the enormous power of the

[1] Kendall and Bailey.
[2] Kendall and Bailey (Plate also).
[3] *Geological Memoir* (Ice Age).

great ice-sheet in East Lothian as the case of Kidlaw, Marl Law, and Woodcote Park limestones. The first is 2½ miles to the south-west of Gifford, the latter two respectively a mile to the north-west and a mile to the east of Fala. These masses, unlike the isolated Lennoxlove outcrop of the Lower Limestone group, 1½ miles south of Haddington, are not outliers, but have been transported bodily to their present positions by ice. The first is a mass a third of a mile long and a quarter broad:[1] it belongs to the middle of the Lower Limestone group, yet rests directly on rocks of the much earlier Calciferous or even of Old Red Sandstone Age: it is in a completely shattered state, and the soil covering both Silurian and Old Red Sandstone formations in the neighbourhood is plenteously supplied with fragments of the same limestone. Evidence showing that the two other masses have been glacially transported is equally convincing: in fact the Woodcote Park example almost certainly reposes directly on rocks of Upper Old Red Sandstone date.

The most ubiquitous result of glacial action is, of course, boulder clay. This consists of the churned up debris of the various kinds of rocks over which the ice has passed. Though containing many boulders carried from considerable distances, it is chiefly composed of the rocks underlying it, or cropping out not far to the west. Thus in the coal-field area in the west the boulder clay is frequently an almost black, stiff, stony clay. To the south of the Tyne valley, where the lowest member of the Carboniferous Group—the Calciferous Sandstone series—occurs, its ground-mass is a tough bluish-grey or purplish clay. Again the boulder clay covering the Old Red Sandstone formations which adjoin the north-west base of the Lammermuirs yields a reddish, light and sandy soil. The boulder clay resting on the conglomerate differs little from ordinary gravel. Just to the south of the Dunbar-Gifford fault change of rock is almost immediately accompanied by change in the nature of the boulder clay, but in other parts the transition is much more gradual: thus at Fala, where Lower Carboniferous rocks outcrop, the dark boulder clay is evidently the off-scourings of coal-bearing formations to the north-west.[2]

Unlike the boulder clay, the gravel and sands[3] swathing the north-west base of the Lammermuirs, and forming the "coastal spread" to their north-east, date from the retreat of the ice-sheet. The former consist of detritus accumulated along the margin of the ice-sheet, much of which was deposited on the floors of ice-dammed lakes, one of which may have extended westward from Deuchrie Dod for fourteen miles. By far the most important terrace thus formed, viz. the Lammermuir terrace, occurs between the 500- and 700-foot contours, where the ice-sheet must have called a somewhat lengthy halt in its retreat. Such terraces often assume a kamiform appearance, which is especially well seen at Woodhall near Spott. As the outlets of these ice-dammed lakes deepened their channels they at length succeeded in emptying the lakes, the floors of which became traversed and dissected by marginal glacial rivers. The

[1] Kendall and Bailey and *Geological Memoir*.

[2] *Geological Memoir* (on Boulder Clay).

[3] *Geological Memoir* (Ice Age).

mounds are thus rarely, if ever, true kames, but are beds of detritus moulded into their present shape by streams. The "coastal spread" is composed of the material which successive marginal drainage rivers deposited on reaching the coastal plain. As the ice-sheet retreated from south to north, the further south such deposits occur, the older they are. Thus the sands and gravels near Dunbar were laid down much later than those near Oldhamstocks.

A few words may here be added on the records left by the great ice-sheet in northern Haddingtonshire.[1] On the north side of the Garleton Hills there are certain step-like features, which were cut by successive marginal drainage streams as the ice retired northward. Not only are these bounded on the south by the usual steep rock-wall, but on the north also by a very diminutive but well-marked ridge, at most but a few feet in height. Such ridges are accounted for by the fact that while sufficient time elapsed to allow the marginal streams to hollow out channels in the rock-floor itself, the ridges were protected from erosion by being covered by the ice-wall.

The marginal channels in the uplands usually bear no trace of the ice-wall which formed their northern bank. In the lowland areas, however, their northern bank of ice is now represented by a quantity of mud and stones, doubtless the residue of the ice after melting. Instances of such low-level channels occur near Balgone House, two miles south-east of North Berwick, and near Smeaton House, to the north of East Linton.[2]

The upper raised beaches within the county are of minor importance. Sandy deposits occurring to the east of Prestonpans, to north and south of the high road east of Gullane, and at the mouths of the Thornton and Dunglass Burns, are probably connected with 100-feet beach times. Evidence of the 75-feet beach, though not always conclusive, is afforded on the north face of Gullane Ness, on the cliffs between North Berwick and the little village of Castleton, and on the cliff-top at Seacliff.

The 25-feet beach,[3] on the other hand, is much more persistent. It is well seen along the coast as far as Aberlady, east of which it is traceable to Longniddry and is often bounded by a steep bank on its inland side. It runs along the coast for 3 miles to the west of North Berwick, is well seen at Seacliff, at the mouth of the Peffer, and in the Tyne estuary vicinity. Part of lower Dunbar is built on it, and from this point to Linkhead, but $1\frac{1}{2}$ miles from the county boundary, its course is only occasionally interrupted.

The widest area of blown sand in East Lothian is situated at Gullane; here it has formed itself round an igneous nucleus, reaches a height of 200 feet, and has extended its area considerably inland. Tracts of blown sand also occur at North Berwick, Aberlady, and Dunbar. It is in fact just such sandy deposits as these that have given rise to the numerous excellent golf courses of the Haddingtonshire coast. A specially interesting case of blown sand is that afforded by Sandy Hirst,[4] a sandy spit which has turned the estuary of the Tyne into a "Haff"-like inlet.

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[1] *Geological Memoir* (Ice Age).
[2] *Geological Memoir* (Ice Age; final remarks).
[3] *Geological Memoir.*
[4] *Geological Memoir.*

## VI.—Climate.[1]

The climate of East Lothian, surrounded as it is on three sides by the sea, is equable. The prevailing wind, which also brings the greatest amount of rain, is westerly (north-west, west, or south-west, but mainly south-west), the east wind being most frequent only in spring.

The mean temperature for the year is 47·5 Fahr., for January 38°, and for July 59°. The average temperature for the three months of spring—March, April, May—works out at somewhat over 45°, while that for the autumn months—September, October, November—to just over 47°. At Yester, 420 feet above sea-level, the mean annual temperature is 46·5°.

The following are the mean temperatures for each month observed at Smeaton, just over the Midlothian border on the Macmerry line, and at Haddington[2]:—

| | Alt. | Jan. | Feb. | Mar. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Smeaton, . | 100′ | 37·7 | 38·2 | 41 | 46·3 | 50·5 | 56·7 | 59·4 | 58·1 | 53·9 | 46·8 | 40·9 | 38·2 |
| Haddington, | 140′ | 37·9 | 38·8 | 39·8 | 44·9 | 49·3 | 55·3 | 58·1 | 57 | 53·6 | 47 | 41·1 | 38·4 |

Perhaps the most noticeable feature of this table is that while the temperature of the two places differs little in autumn and early winter, Smeaton has a higher temperature by a degree or more from March to the end of August.

If anything, the climate of East Lothian is too dry. For the county, the mean annual rainfall is about 25 inches. The chief reason, doubtless, for this small amount of rain is that the moist south-west winds are robbed of much of their rain by the hills to the south and south-west before reaching East Lothian. The following table shows the average rainfall of eight places in Haddingtonshire for each month in the year:—

*Rainfall in Inches.*[3]

| | Alt. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tyneholm, . | 248′ | 2 | 1·58 | 1·75 | 1·83 | 1·9 | 2·17 | 3·23 | 2·96 | 2·76 | 2·33 | 2·8 | 2 | 27·25 |
| Haddington, . | 140 | 2·29 | 1·76 | 1·93 | 1·8 | 1·78 | 1·86 | 3·19 | 2·82 | 2·61 | 2·33 | 2·82 | 2·16 | 26·86 |
| Aberlady, . | sea level | 2·17 | 1·74 | 1·7 | 1·84 | 1·8 | 1·8 | 2·94 | 2·74 | 2·6 | 2·28 | 2·4 | 1·95 | 26·02 |
| Seacliff, . | 80 | 1·98 | 1·45 | 1·74 | 1·75 | 1·74 | 1·78 | 2·95 | 2·47 | 2·38 | 2·34 | 2·29 | 1·88 | 24·55 |
| Smeaton, . | 100′ | 1·91 | 1·51 | 1·56 | 1·76 | 1·73 | 1·91 | 3·25 | 2·77 | 2·57 | 2·23 | 2·56 | 1·93 | 25·07 |
| East Linton, . | 90′ | 1·94 | 1·52 | 1·72 | 1·79 | 1·74 | 1·91 | 3·07 | 2·69 | 2·47 | 2·24 | 2·61 | 2·01 | 25·72 |
| Thurston, . | 327′ | 2·03 | 1·91 | 1·93 | 2·01 | 1·88 | 1·93 | 3·12 | 2·96 | 2·82 | 2·7 | 2·89 | 2·62 | 28·8 |
| Yester, . | 425 | 2·14 | 2·08 | 2·28 | 2·18 | 2·17 | 2·28 | 3·44 | 3·04 | 3·35 | 2·96 | 3·27 | 2·65 | 31·84 |

At every one of these stations the maximum rainfall occurs in July, while the months of February, March, and April, when east

[1] Authorities: *Reports of Scottish Meteorological Society; British Rainfall.*

[2] *Scottish Meteorological Reports.*

[3] Observations cover a period of twenty-five years.

winds are most frequent, are the driest. From February to July about forty-five per cent. of the year's rain falls, while about fifty-five per cent. falls during the remaining six months. Among the Lammermuirs, as might be expected, the heaviest rainfall is recorded; thus the annual averages at Yester and Thurston, two hill stations, are 31·8 and 28·8 respectively. It is highly probable that rain observations made higher up on the Lammermuirs would furnish us with records of heavier falls; *e.g.* the average for the past six years at Dunolly Burn reservoir (560 ft.), near Garvald, is 34·9 inches, and this is probably not the greatest precipitation in the district. Moreover, no rain-gauge satisfactorily measures the moisture the southern part of the county receives from the wetting mists of the Lammermuirs, which are almost indispensable to the farmer in spring.

On the other hand it may safely be said that at no point north of a line drawn from Tranent through Haddington to Innerwick does the average annual rainfall exceed 27 inches.

## VII.—Farming.[1]

The chief occupation in East Lothian is agriculture. For long the county has been noted for the excellence of its agricultural products, and while this success is due in no small measure to its favourable climate and its good soil, it is due quite as much to the enterprise and enlightenment of its farmers, and to their zeal for new and scientific methods. The rise of agricultural prosperity in East Lothian dates from the beginning of the eighteenth century, and the first two men to combat the poor and antiquated methods till then pursued in the county were Cockburn, the laird of Ormiston, and Andrew Fletcher of Salton. James Meikle, after a prolonged tour on the Continent to study foreign methods, set up in Salton in 1712 the first barley mill in Scotland, and introduced fanners for winnowing corn—improvements which did not pass into general use throughout the country for another forty years. In 1734 the first turnips were sown by drill in Scotland by Lee of Skateraw, near Innerwick. At the farm of Lochend in Dunbar parish the first Swedish turnips in Great Britain were grown in 1784. Haddingtonshire farmers were the earliest in Scotland to adopt the thrashing-machine (1787), the steam plough (1862), and the reaping-machine. East Lothian is also connected with important improvements in wheat culture, carried out by Shirreff about the middle of the nineteenth century.

The poorest soils are those overlying rocks of Silurian age and Old Red Sandstone conglomerates, both of which are confined to the Lammermuir uplands, and are suitable only for hill pasture. The lowlands are composed of Old Red Sandstone, of Carboniferous and volcanic rocks, and are for the most part cultivated. Skirting the north-west and

[1] The chief authorities for this section are:—Croal, *Sketches of East Lothian* (1873); Martine, *Reminiscences of Haddington* (1890); *Scottish Gazetteer;* Scott Skirving, *Agriculture in East Lothian* (*Trans. Highland and Agricultural Soc.*, v. 1873); *Geological Survey Memoir* (East Lothian); *Agricultural Returns*, 1911.

north-east base of the Lammermuirs is a belt of moderately fertile land, composed of glacial gravels and sands; where it bends round it meets the red Dunbar loam, and the combination of these soils yields perhaps the best potatoes in Scotland—the "Dunbar Reds." Separated from the Lammermuirs by this band is a strip of tough yellow clay resting on a subsoil of till, which forms parts of the parishes of Garvald, Norham, Haddington, Bolton, Humbie, Pencaitland, Yester, and has been described as the poorest soil in the whole lowland of Scotland: this land, however, might quite profitably be more extensively afforested, as such trees as the oak, beech, larch, and fir thrive on it. For the most part it coincides with the Calciferous Sandstone series, to which glacial action has added fragments of Upper Carboniferous rocks. The strip of country which extends from Garvald eastward to Dunbar and coincides with rocks of Old Red Sandstone age possesses a much lighter soil, composed of a sandy boulder-clay. The valley of the Tyne is greatly enriched by extensive deposits of alluvium. On the Garleton Hills the covering of glacial drift is very thin, and as a result the fields become very much parched in dry weather. But it is on one of these hills that the largest area of fertile land occurs: here the boulder-clay consists of the débris of sandstone, limestone, shale, and igneous rocks, which last make an especially rich soil. Finally, there is the west coastal tract, where the blown sand and raised sea-beaches form an excellent sandy soil well suited for market-gardening.

South of the Tyne the country is adequately supplied with water, as it is served by streams flowing from the wet Lammermuir uplands. North of it, where the rainfall is smaller, the rocks in parts porous, and only a few insignificant rivers (such as the two Peffer Burns, one of which takes its rise in the dry Garleton Hills, the other in the equally dry uplands just south of North Berwick) water the country, the fields suffer from drought in dry summers.

Of the 171,389 acres which make up the total area of East Lothian, 89,606 acres, or about 52¼ per cent., are arable land: 38,982 acres mountain or hill pasture: 22,108 acres "permanent grass": while in 1905 10,777 acres, or rather more than 6 per cent., were occupied by woods and plantations, as against 10,442 acres in 1895.

Somewhat more than 22 per cent. of the county is annually sown with grain crops, of which the following are recent figures:—

| Crop | Total amount in quarters (1911). | Number of Acres. | | | Average yield (1901-10) per acre in bushels. |
|---|---|---|---|---|---|
| | | 1911 | 1891 | 1881 | |
| Wheat. . | 41,381 | 7,658 | 6,034 | 8,748 | 42·47 |
| Barley. . | 74,653 | 13,736 | 14,944 | 17,525 | 41·55 |
| Oats . . | 82,823 | 15,976 | 16,785 | 17,081 | ... |

In Midlothian the average yield of bushels of wheat per acre is 46·46, in Linlithgow 43·40, in Ayrshire 42·95, in Lancashire—the highest in England and Wales—only 34·83. In the case of barley only

Midlothian, with an average yield of 43·73 bushels per acre, and Linlithgow, with 43·61 bushels, surpass Haddingtonshire; while Kent, with an average yield of 38·24, is the highest in England, if London county be left out of account. As regards oats only Forfar, with 47·63 bushels per acre, and Ayrshire, with 47·34, show a superior yield in Scotland; but Lincolnshire, with 49·93 bushels per acre, ranks first of all. Barley and oats are grown almost everywhere throughout the county, even on the slopes of the Lammermuirs, but wheat thrives best to the north of the Garleton Hills, and in the coastal districts.

Nearly 14 per cent. of the county is devoted to the growing of root crops:—

| Crop. | Total amount in tons (1911). | Number of Acres. | | | Average yield of tons per acre (1901-10). |
|---|---|---|---|---|---|
| | | 1911 | 1891 | 1881 | |
| Potatoes . | 67,362 | 7,649 | 7,649 | 9,281 | 7·32 |
| Turnips . | 198,124[1] | 14,337 | 15,711 | 15,447 | 19·19 |
| Mangold . | 5,029 | 267 | ... | ... | 20·19 |

In spite of Haddington's reputation for potato-growing, no fewer than seven Scottish counties show a superior yield to it per acre, the figures for Clackmannan being as high as 8·49. In four Scottish counties the yield of turnips per acre is higher than that of East Lothian, while Brecknockshire in Wales surpasses them all with 20·77 tons per acre.

The cultivation of no crop has declined more than that of beans; while in 1853 there were 4809 acres, in 1911 the number had fallen to 316 acres.

Small fruit occupies an area of 336 acres, of which 182 are devoted to strawberries, a figure only exceeded in Scotland by Lanarkshire, Perthshire, and Aberdeenshire. These are chiefly grown between Prestonpans and Longniddry, and in the parish of Ormiston, districts within easy access of the Edinburgh market.

About $7\frac{3}{4}$ per cent., or 13,566 acres of the county, is under grass of all kinds grown for hay.

Owing to the excellence of the land for agriculture, the rearing of live stock (with the exception of sheep) takes but a secondary place, as the following figures show:—

| | 1911. | 1891. | 1881. |
|---|---|---|---|
| Horses, . | 3,771 | 3,521 | 3,442 |
| Cattle, . | 11,179* | 8,196 | 9,062 |
| Sheep, . | 130,848 | 133,705 | 111,928 |
| Pigs, . | 2,289† | ... | ... |

* 9847 in 1910. † 1506 in 1910.

Dairy-farming is a pursuit little practised in the county. In fact,

[1] An exceptionally poor year; yield per acre for 1911 only 13·82, as against 20·33 for 1910 (297,737 tons in 1910).

there are a number of large farms which do not produce sufficient milk and butter for their own consumption.

Sheep-rearing, however, has always been an important pursuit. It was the abundance of sheep in the county which gave rise to the woollen industry two centuries ago. The average number of sheep per square mile is 490. Argyllshire, with the greatest number of sheep in Scotland (over 800,000), has only an average of 230 sheep per square mile. The chief varieties on the hills are Cheviots and black-faced sheep, and on lowland pastures Leicesters and Southdowns.

The county contains an unusual number of large holdings, as the following figures indicate:—

*Number and Size of Agricultural Holdings.*

| 1-5 acres. | 5-50 acres. | 50-300 acres. | Above 300 acres. | Total. |
|---|---|---|---|---|
| 78 | 128 | 174 | 170 | 550 |

*Percentage of each Class of Holdings to Total.*

| | | | |
|---|---|---|---|
| 14·17 | 23·27 | 31·67 | 30·89 |

No other county in Great Britain has so large a percentage of farms above 300 acres. Berwick, which comes next, has only 27 per cent., and Northumberland, the highest in England, has only 12·3 per cent. The average size of a holding in East Lothian is 203 acres: in Berwickshire, the highest in Great Britain, it is 218·4: and in Northumberland, which comes third, it is only 119·9 acres.

*(To be continued.)*

## A BOOK OF DISCOVERY.[1]

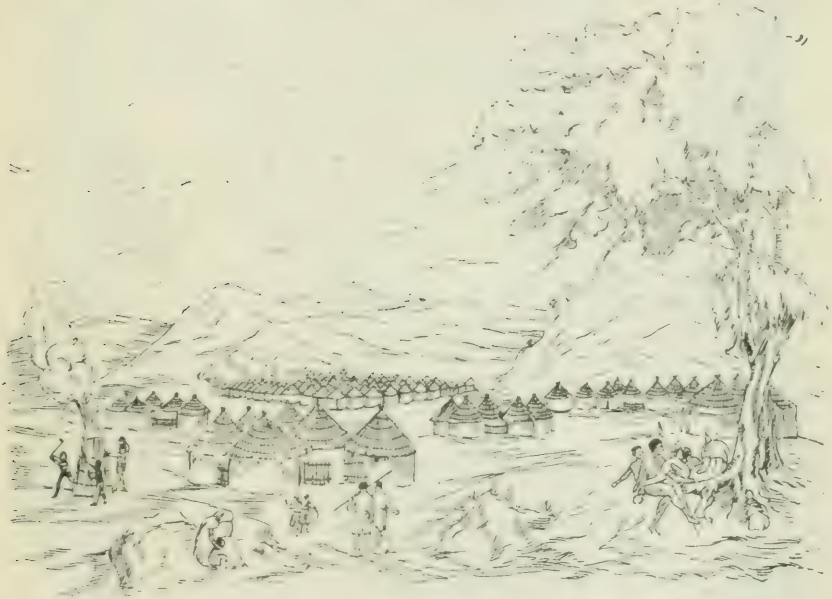
*(With Illustrations.)*

This substantial and beautifully illustrated volume is one which should be put into the hands of every schoolboy in the United Kingdom and Empire. A perusal of it stirs the heart and warms the imagination of greybeards, and in the hopeful and sanguine temperament of the healthy schoolboy it cannot fail to evoke a wholesome enthusiasm and genuine admiration for the splendid achievements of his forefathers, and to provide a powerful stimulus to emulate the heroism of the past. If hero-worship is now, as some allege, a thing of the past, this book may do something to revive it at least in the minds of the young people of a money-loving and materialistic age. The book is substantial, it has some 550 pages, but the author suffers from the abundance of his material, and the reader is tantalised by the fact that story after story of entrancing interest has to be compressed into a few pages which merely whet the appetite. If the book has the much-to-be-desired effect of sending its readers, old and young, to the detailed accounts of the great dis-

[1] *A Book of Discovery.* By M. B. Synge, F.R.Hist.S. London and Edinburgh: T. C. and E. C. Jack, 1912. Price 7s. 6d. net.

Livingstone, with his wife and family, at the discovery of Lake Ngami. (From Livingstone's *Missionary Travels.*)

coveries, it will go far to spread and deepen the general interest in geography, history, and ethnography. It cannot fail to excite admiration for the courage and resourcefulness of such navigators as Columbus, Drake, Magellan and Cook, or of such travellers as Marco Polo and "resolute and intelligent" Anthony Jenkinson, who with what we would now consider an inadequate minimum of appliances and knowledge undertook and carried out feats of exploration which have ever commanded the applause and admiration of posterity. "There is no land uninhabitable and no sea unnavigable" was the watchword of the men of the sixteenth century, the golden age of exploration, and in this spirit they set forth



Kamalia, a native village near the southern course of the Niger.
(From a Sketch by Mungo Park.)

on expedition after expedition with calm resolution and stern resolve to overcome the formidable difficulties which they well knew would present themselves on sea and on land. They paid for their daring and their hardihood right dearly, but no misfortune and no calamity was allowed to put an end to their endeavours. Whether the reader of this book be young or old is immaterial: he can hardly fail to gather some of the many lessons which may be deduced from its pages. There is the marked contrast between the conditions of former and present exploration, the equally marked contrast between the objects and methods of exploration by former and later explorers, and the contrast between the standards of success applied to such expeditions by their contemporaries. Yet he will observe that the qualifications of the successful explorer remain much the same in all ages—a dauntless and romantic spirit of

adventure in a personality which inspires and retains the confidence of his followers, a courage eager to penetrate into the unknown, and undeterred by repeated disastrous experiences such as storms, uncharted shores, and scurvy at sea, or starvation and death, possibly by the poisoned arrows of savage cannibals by land; and he will note that this spirit of adventure may be evoked by patriotism as in the case of Raleigh and Drake, or by the prospect of gain as in the case of Le Maire and Cortes, or by pity for the sake of down-trodden and ignorant humanity as in the case of Livingstone, or for the sake of pure science as in the case of Peary and Amundsen. Doubtless in most of these expeditions the explorers were animated by more motives than one, and part of the enjoyment as well as part of the education of the reader will consist in disentangling their motives and estimating wisely and justly their characters. For example, it will take some careful and earnest thinking to estimate correctly how much of Drake was buccaneer and how much was patriot: how much of Cortes was missionary and how much was military freebooter: how much Peary was actuated by the pursuit of pure science and how much by the hope of imperishable fame. We do not often hear of an explorer animated by the purest unselfishness like Livingstone, whose brilliant feats of exploration were undoubtedly merely ancillary to his main purpose of service to humanity by the spread of Christianity and the destruction of the slave-trade.

It is difficult to make a selection, but we think Mr. Synge has been particularly successful in his narratives of the expeditions despatched to achieve the North-East and the North-West passages, and of the opening-up of Canada and of Africa. A captious critic might take exception to his including such names as those of St. Patrick, Alexander the Great, and Julius Caesar in the list of explorers. The primary object of their expeditions was certainly not exploration, but, as we have already noted, neither was exploration the primary object of the greatest explorer of last century, David Livingstone. Conceding the fact that ruthless condensation was absolutely necessary, we may state that the stories are exceedingly well told, often with sufficient detail to give the reader a vivid idea of the hardships and trials the explorers had to undergo, and illustrated sometimes with an apt quotation from their reports or journals. Of one kind is Pizarro's address to his ragged starving followers: "Friends, on that side are toil, hunger, nakedness, the drenching storm, desertion, and death, and on this side ease and pleasure. There lies Peru with its riches, here Panama and its poverty: I go south." Of another kind is the inexpressibly sad last entry in Livingstone's journal: "27 (April 1873). Knocked up quite. We are on the banks of the Molilamo."

The maps and illustrations, of which, by the courtesy of the publishers, we are able to give specimens, are exceptionally varied and interesting. Eight of them are coloured, of which we may mention Ptolemy's map of the world about 150 A.D. and the Hereford Mappa Mundi of 1280 A.D. There is also an instructive series of six maps entitled the gradual "unrolling of the clouds," showing the world as it was known to geographers at six different periods, beginning with the

Captain Cook with his ships at Kealakekua, Hawaii, where he was murdered. (From an engraving in the Atlas to *Cook's Voyages*, 1779.)

time of Homer and ending with that of the circumnavigation of the world by Cook. There are over 150 other exceedingly interesting and quaint illustrations, taken from a great number of sources, some of them at least not easily accessible to the general reader. The book is remarkably cheap for its size and get-up.

## PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

### Meeting of Council.

At a Meeting of Council held on Tuesday, 12th November, the following ladies and gentlemen were elected Ordinary Members of the Society :—

R. B. Greig, F.R.S.E.
Professor S. G. Mellis Smith, M.A.
H. F. Wilson, B.A., B.C. (Cantab.).
Miss Mary B. Bannatyne.
Miss Christison.
Captain A. C. Robinson, R.E.
Mrs. John Hope.
Alfred J. Miller, M.A.
George Bowie Sawers.
W. S. Colville, M.A., LL.B.
John Wilson.
Charles Pullar Young.
Alexander Hamilton.
W. C. Fairweather, M.A.
Miss Eleanor Wylie.
W. A. Dickson.
Rev. S. B. Rohold.
Hugh Miller.
Mrs. M. T. Spriggs.
Thomas L. Millar, M.A.
W. C. Drummond.
R. M. Hunter, F.F.A.
Mrs. D. Mather.
A. Munro, J.P.
A. Andrew, M.A.
William Smith, Junr.
Mrs. William Melville.
John S. Lawson.
R. D. Croall.
T. Burges, L.R.C.P. & S., Edin.
James Brown.
John T. Nimmo.
J. M. Dewar, M.A.
Bernhard Pedersen.
J. Ker Goalen, C.A.
Miss M. Tweedie.
Mrs. G. Watson.
Commander D. J. Munro, R.N.
R. H. F. Moncreiff.
H. A. Boyd.
Robert Blakely.
Sheriff Alexander Moffatt.
Mrs. G. W. Benham.

The following were elected Teacher Associate Members :—

Miss G. A. Lothian, M.A.
Miss E. L. S. Ross.
Miss Elizabeth P. Hogg.
Miss Agnes MacFarlane, L.L.A.
Miss Helen Gray.
Miss Jessie Hendry.
Miss Isa Gordon, M.A.
Miss Flora Sutherland.
Miss Annie Gordon.
Miss A. H. Dunn.
J. A. Murray, M.A.
Miss M. J. C. Reid, M.A.
Miss Annie Sherriffs.
Miss B. C. Marshall, M.A.
Miss N. M. Strouts.
Miss Annie B. Crow.
George Clark, M.A.
Miss M. R. Mather, M.A.
James Wood, F.E.I.S.

### Medal Awards.

The Council unanimously agreed to award the Society's Silver Medal to Captain Ejnar Mikkelsen for his explorations in North-Eastern Greenland. The Silver Medal given by the Society for competition among the students of geography at Edinburgh University was awarded to Mr. Laurance J. Saunders for his essay on "A Geographical Description of Fife, Kinross, and Clackmannan."

### Diploma of Fellowship.

The ordinary Diploma of Fellowship was conferred on the Rev. S. B. Rohold, Toronto.

### Lectures in December.

Mrs. Mary Gaunt will address the Society in Aberdeen and Dundee on the 3rd and 4th of December respectively. The title of her lecture will be "A New View of West Africa." On the 12th and 13th of December in Glasgow and Edinburgh, the Hon. Sir Newton J. Moore, K.C.M.G., J.P., M.L.A., Agent-General for Western Australia, will address the Society. "Ahead of Civilisation: Some Aspects of Pioneer Work in a New State," will be the title of the lecture. Mr. Kingdon Ward, F.R.G.S., will address the Society in Aberdeen and Dundee on the 17th and 18th of December respectively on "The Wanderings of a Naturalist in Tibet and Western China."

### Annual Business Meeting.

The annual meeting of the Society was held on Tuesday, November 12, in the Council-room in the Synod Hall, Edinburgh,—the Earl of Stair, President, in the Chair. His Lordship said the lecture programme for the ensuing session had distinctive features which would appeal to the members. Captain Amundsen was to open the course with an address on his journey to the South Pole. With great daring he chose an independent base for his operations, and a new route from that base to the Pole. His journey was remarkable for the rapidity of his march, and the important scientific results which he obtained. The Council had also been fortunate in securing the services of Captain Mikkelsen, who would give an address on the Danish expedition to North-Eastern Greenland. Although the geographical results in this case were of minor importance, yet the hardships which the leader endured, and his fortitude in overcoming them, made his return journey of two years a thrilling tale. They were also to have an account of the geographical results of the Abor expedition by Mr. Bentinck, an expedition which was extremely successful, and the account of which would be of great interest to the Society. Reference, he said, ought also to be made to the address to be delivered by Sir Harry Johnston towards the end of March in connection with the centenary of the birth of David Livingstone. That subject naturally appealed strongly to the members of the

Royal Scottish Geographical Society. They would all regret that Dr. Livingstone's daughter had not survived for this very interesting occasion.

The Secretary then read the Annual Report (see pp. 668-70), and Mr. James Currie, M.A., F.R.S.G.S., Hon. Treasurer, made a statement in regard to the finances of the Society. The list of Council and office-bearers recommended by the Council for election was submitted to the meeting, and on the motion of Mr. Lee, seconded by Mr. Glendinning, the report was adopted, and the Council and office-bearers as recommended were unanimously elected. Of the sixteen members of Council retiring by rotation among the Edinburgh members, the following were re-elected:—Professor Richard Lodge, LL.D., A. L. Cross, and Professor T. Hudson Beare, B.Sc.

The following were re-elected for the other centres:—

*Glasgow*:—A. E. Maylard, B.Sc., and Professor D. J. Medley.

*Dundee*:—Professor J. Yule Mackay, and A. B. Gilroy.

*Aberdeen*:—Very Rev. Principal G. Adam Smith, D.D., LL.D., and Professor J. Arthur Thomson, M.A.

The following members of the Society were elected to fill the vacancies existing:—For *Edinburgh*,—Principal A. P. Laurie and T. Scott Muir; *Glasgow*,—William Ewing; *Dundee*,—Thomas Murdoch; and *Aberdeen*,—Rev. John Kelman, D.D.

The Chairmen of the Glasgow, Dundee, and Aberdeen Centres were re-elected:—For *Glasgow*,—Paul Rottenburg, LL.D.; *Dundee*,—R. B. Don, J.P.; *Aberdeen*,—G. M. Cook, J.P.

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## GEOGRAPHICAL NOTES.

### Europe.

**Swiss National Park.**—The *Société Helvétique des Sciences Naturelles* has succeeded in making all arrangements for the establishment of a magnificent national park, of which an account was given by Dr. Paul Sarasin at the September meeting of the Society at Altdorf. The park is situated in the canton Grisons, in the lower valley of the Inn, near Zernetz, and consists meantime of an interrupted stretch of land about forty square miles in extent, which it is hoped later to increase to nearly eighty square miles. All this vast territory will be wholly withdrawn from human interference, and set aside as a biological preserve. It contains at present chamois, a few bears, and a rich flora. Some paths are to be made, together with blockhouses to suppress poaching, and regular observations will be undertaken. Part of the territory has been leased for twenty-five years, and the rest for ninety-nine years, and the cost of rent, surveillance, and observations are to be defrayed out of the funds supplied by a popular league, with a very low annual subscription. This huge park, as is pointed out in *Nature*, is the most important in Europe so far as extent goes, and in some respects exceeds the great American Reserves.

**A Glacier on Hekla.**—In the October number of *Petermann's Mitteilungen* there is a short note by Dr. Helgi Pjeturss on Hekla which brings forward an interesting point. As he says, it would hardly be supposed that anything new could be discovered on a mountain so well known as Hekla, but he has discovered there on the north side an interesting glacier. Thoroddsen says that Hekla has no glacier, but describes a mass of *firn* marked by innumerable crevasses. Pjeturss says that this is a true glacier, and Thoroddsen's refusal to recognise it as such was apparently due to the absence of a glacier stream. But the cause of the apparent absence of the stream is the porous nature of the rock in the glacier bed, which allows the glacial water to pass through. This water, filtered by its passage through the pumice, appears as one of the factors of the Ytri-Ranga, and helps to give that river its crystal clearness. The observation has a double interest. In the first place, it helps to explain the origin of some puzzling rocks known in Iceland, which are apparently volcanic tuffs with the pores filled by glacier mud. Second, glaciers such as the Hekla one can only be of recent origin, for in course of time the pores of the volcanic rock must be choked by the glacier mud, and the rock will thus become impermeable, when a stream is bound to appear at the surface.

## Asia.

**Expedition to the Karakoram.**—It is announced in the *Times* that Dr. Filippo di Filippi proposes to undertake a scientific expedition to the Western Himalaya and the Karakoram, the plans of which have been submitted to the Royal Geographical Society and approved by them.

Dr. de Filippi's name is well known in connection with three of the great expeditions which have been so successfully accomplished by the Duke of the Abruzzi, first to Mt. St. Elias in Alaska, second to Mt. Ruwenzori in Central Africa, and lastly to the Karakoram Mountains. The expedition now proposed, if carried out on the plan drawn up, will probably be the most important from the scientific point of view that has ever entered the Himalayas. The problems under investigation concern topography, geology, gravity, magnetism, and the various forms of radiation and atmospheric electricity. To these subjects would be added studies in meteorology, with the special view of investigating the higher atmosphere with kites carrying self-registering instruments sent up from stations of high altitude. The special physical characteristics of the Himalaya-Karakoram region, added to the comparative facility with which high altitudes can be reached in it, the dryness of the atmosphere, etc., afford unique opportunities for these researches.

It is proposed to carry on the investigations from Kashmir, over the Himalaya range, and through Baltistan and Ladakh into Chinese Turkestan. Dr. de Filippi intends to take advantage of the occasion afforded by the expedition to explore and map the still unknown portion of the Karakoram between the Siachen glacier and the Kara-

koram pass. It would be a matter of the greatest interest in this district to look for a continuation of the great sedimentary (limestone) formation discovered by the Duke of the Abruzzi in the Baltoro basin and by Dr. Longstaff at the head of the Siachen glacier. The plan entails wintering in Baltistan or in Ladakh, and the expedition would extend over a period of something more than a year.

The amount necessary to cover the expenses of such an enterprise is about £10,000. Of this £6000 has already been contributed (£4800 in Italy). It is hoped that the sum necessary to complete the amount may be subscribed.

## Africa.

**The Spread of Islam in Africa.**—Dr. Karl W. Kumm has furnished us with the following note upon this subject:—

"We possess to-day little digested scientific material on the influence the orographical conditions of the earth's surface have had on the commencement, spread, and maintenance of the leading religions, leaving out of the question the more unimportant animistic forms. The three monotheistic desert-born religions, no less than Buddhism, have followed in their spread certain clearly defined routes of trade and traffic, and they have found in times of persecution places of refuge in more or less inaccessible mountain ranges (*e.g.* in Abyssinia, Tibet, the Alps, etc.). The modern spread of Islam, on which we have a dissertation from the Rev. Edward Kittlaus, in the thirtieth volume of the *Proceedings of the Geographical Society of Jena*, is of considerable importance with regard to the development, the national economy, and the political future of the countries concerned. On the Central African ironstone plateau between the Niger and the Nile there are still some fifty pagan tribes: but one after another they are now going over to Islam, and indeed it is held by certain careful observers that before very long the whole population of the Guinea Coast, the Bantu, and the South African negroes, will follow them with few exceptions.

"In a suburb of Cape Town the mayor of that city laid the foundation stone last year of a new Moslem religious educational institution. The conversion of the negroes to Islam may be a step forward, but it may also lead to fanatical religious wars against the Europeans. In the Anglo-Egyptian Sudan the Mahdi revolt reduced the population of that country in thirteen years (1885 to 1898) from seven millions and a half to one million and a half. The modern advance of Islam should be watched by geographers in this and the coming generation."

## America.

**Exploration in the Hudson Bay Region.**—Mr. J. B. Tyrrell, Consulting Geologist, of Toronto, Canada, has, he informs us, just returned from an extended expedition into the Hudson Bay region. He went northward in the early summer by the ordinary trade route to the mouth of the Nelson River, spent the remainder of the summer on Hudson Bay, and

returned from the Bay up the Severn River, and by a previously unexplored route across the new district of Patricia to the line of the Grand Trunk Pacific Railway.

**Anthropological Investigations in South America.**—Professor F. Ameghino has at various times announced discoveries of what he regards as remains of very early man in Brazil and Argentina, and on the basis of these has put forward the view that man evolved in South America from pre-human ancestors, whose vestiges he claims to have discovered, and that from South America as a centre he spread over the world. Professor Ameghino claims to have found artifacts dating back to the Upper Eocene, and skeletal remains dating to the Upper Miocene. Doubts have been expressed as to the nature and date of these finds, and in 1910 Dr. Hrdlička, of the United States National Museum, accompanied by Mr. Bailey Willis as geologist, made an expedition to South America with the object of studying the whole question. Their results are published as *Bulletin* 52 of the Bureau of American Ethnology, under the title of "Early Man in South America." These results are of an entirely negative character. The facts obtained, Dr. Hrdlička says, only attest the presence of the already differentiated and relatively modern American Indian. Up to the present time, he states, the evidence is unfavourable to the hypothesis of man's great antiquity, and especially to the existence of human predecessors in the continent. Dr. Hrdlička points out, however, that his conclusions are based upon evidence previously obtained, in regard to which he considers various errors of geological horizon and of description have been made. That is, he does not deal on broad grounds with the general problem, but only criticises the evidence which has been offered in support of the hypothesis of man's great antiquity in South America.

A large amount of material was collected during the course of the expedition, and this has been deposited in the National Museum.

**The History of the South American Continent.**—Under the general title of "Some Factors of Geographical Distribution in South America," Mr. John D. Haseman publishes in the *Annals* of the New York Academy of Sciences, a very elaborate paper on the structure and geological history of South America. It is well known that this continent contains some curiously primitive animals, as for instance representatives of both the herbivorous and carnivorous types of marsupials, and that its fauna is also characterised by the absence of many of the animals found in the northern hemisphere, though it offers certain resemblances to that of Africa. Many hypotheses have been advanced to explain the peculiarities of the South American fauna, recent and fossil. One, which has a considerable following, is that in late Palæozoic times a continent—Gondwana Land—extended across the southern hemisphere and connected India, Australia, South Africa, and South America. This is the view supported by Suess, and it has of course a far wider bearing than the mere question of the origin of the South American fauna. Von Ihering, whose book was reviewed here in vol.

xxiv. p. 273, elaborated this hypothesis in various ways, calling the hypothetical bridge between South America and Africa, Archhelenis, and the supposed continent which connected South America through the Antarctic area to Australia, Archinotis. As against such views a considerable body of opinion adheres to the view that the great ocean depths have never been dry land, and therefore that Archhelenis is an impossibility. Mr. Haseman discusses his subject under two headings: (1) the geology and topography of South America, and (2) the distribution of South American fishes. The paper is based in part upon his extensive travels in South America while collecting fishes for the Carnegie Museum, and partly upon the work of other observers. Much of the reasoning is too detailed and technical to be summarised here, but the more general points seem of sufficient geographical interest to be given briefly.

In the first place, Mr. Haseman discusses the distribution of the different sedimentary rocks in South America, so far as this is known or surmised, illustrating by a series of maps. The result is to show that the present continent is nearly surrounded by a rim of Archaean beds, while from the Guianas there extends southwards through Brazil into Uruguay, and west to Bolivia, a sand-capped tableland, which he calls the Plano Alto, whose component rocks appear to have been laid down in a freshwater basin in Permian times. Since Permian times this region has been remarkably stable, as shown by the absence of marine beds, and, generally, the author is of opinion that the rocks of South America, no less than its trend-lines, indicate that the continent has had approximately its present form through geological time. Such invasions of the sea as have occurred must, he thinks, have been north-to-south in direction, and not east-to-west as the Archhelenis theory demands.

As an incidental result of this study of the form of the continent, the author comes to the conclusion that there has been a reversal of the direction of the flow of the Amazon, the old divide having been placed somewhere near Obidos. In (probably) Mesozoic and early Tertiary times the sea invaded the region lying to the west of the Plano Alto, that which now forms the present site of the Andes, producing the East Andean Sea. Into this sea the Amazon flowed from its origin near Obidos. When, in Tertiary times, the Andes gradually rose, the westward opening of the East Andean Sea was gradually cut off. About the same time the low divide at Obidos was cut down by stream capture, and for a time the Sea had two outlets, one to the west and the other *via* the Amazon to the east. The former was gradually closed, and the rush of the water eastward destroyed all trace of the old divide.

Numerous instances of incipient or accomplished stream capture are further observable at the present time on the Plano Alto, owing to the unequal dissection of the tableland. One of the most interesting of those described is the familiar one of the Cassiquiare, which connects the Orinoco with the Rio Negro. The author states that this is piracy on the part of the Orinoco, which, owing to the steeper eastern and

northern slope of the highlands, is cutting down the land more rapidly than the Rio Negro, which is running in a region of gentler slope.

The second part of the paper, that dealing with South American fishes, is too technical for discussion here, but we may note briefly that the author considers that there is no biological evidence pointing to a connection with Africa which is strong enough to outweigh the geological evidence against the hypothesis. He believes that land animals originated in the northern hemisphere, and have been dispersed through the three great tongues of land which now, as always, extend southwards. He grants the possibility of a connection of these three land masses by means of the Antarctic region ("at some time previous to the Carboniferous epoch"), but thinks the evidence even for this is slight, and will not agree to any later connection. Perhaps the only comment upon the paper which it is meantime safe to make is that the subject appears to be one upon which as yet it is impossible for any one to make an authoritative pronouncement. Further exploration in the Antarctic region will no doubt help the geologists and biologists to arrive at a decision, if combined with the further field work in zoology in Central Asia and northern South America for which the author appeals.

**The Forest Trees of California.**—Mr. W. L. Jephson has published as vol. ii. of the *Memoirs* of the University of California, an elaborate and well-illustrated volume entitled *The Silva of California*. Though dated 1910, this monograph has just reached us recently. It gives an account of the forest trees of the region, which will be found useful alike to the arboriculturist and the geographer, for the former frequently meets Californian conifers in collections, while to the latter the contrast between the eastern and the western forests in the United States of America reflects, in a very striking fashion, the climatic contrast.

The trees of California are predominantly coniferous. Of ninety-two species represented, forty-two are Gymnosperms, the pines being especially abundant. This predominance is even more evident in the field than in statistical tables, for only the conifers are individually numerous. In tables the number of broad leaved (mostly evergreen) species seems relatively large, but the individuals are few. This means, of course, that the climatic conditions in California are unsuited to the modern types of arborescent vegetation, and only the more primitive forms can keep their hold. Another effect of the relatively unfavourable conditions is seen in the restricted range of many species. No less than eighteen species are peculiar, but on the other hand the elms, beeches, true chestnuts, and hickories of the eastern forests are completely wanting. A very interesting analogy with the Mediterranean region is seen in the presence in unfavourable regions of what is called chaparral, which is defined as follows:—"The chaparral is a shrub area, consisting not of a single species, but of many species belonging to many different families, which have assumed a common habit in response to the hard conditions of their growth. They are characterised by their rigid stems, often bearing thorn-like branchlets, and small, thick or leathery leaves, in some cases, as in the Manzanitas, placed vertically to escape the direct

rays of the sun. In addition to these genuine chaparral shrubs, certain trees recur in the chaparral in shrub form." Chaparral occurs in the lower levels where the temperature conditions and rainfall are very unsuited to tree growth. The analogy with the maquis of the Mediterranean area is thus singularly close.

The forests can be divided into no less than five groups, each of which corresponds to a separate region, characterised alike by topography and by climate. Thus the trees of the North Coast Ranges differ from those of the South, and both alike from those of the combined Sacremento and San Joaquin valleys and the Sierra Nevada, while Southern California forms a fifth province. A few words may be said as to each of these divisions.

The Sacremento and Joaquin valleys are really one, and form an area of about 400 miles in length with an average width of 30 miles, which is almost level and characteristically treeless. When trees occur they form thin groves especially at the eastern side of the valley, on the deltas of the perennial streams which flow from the Sierra Nevada. Curiously enough, however, while the climate seems very unsuited to tree growth, yet planted trees do well. Part of the reason, perhaps, lies in the former prevalence of grass fires, while the climatic conditions also seem to render natural reproduction difficult, though they have a less marked effect on the trees themselves. The chief trees are oaks, willows, and cottonwood.

In the South Coast Ranges, the valleys have oak woods, and some of the slopes are pine-clad, this being especially true of the seaward slopes. Nevertheless, large barren areas occur, and natural reproduction seems to be effected with great difficulty. Some of the species are exceedingly local in their distribution—an example being the Monterey cypress, which is confined to the shores of the Carmel river.

In the North Coast Ranges conditions are much more favourable, and with control of forest fires the wooded area is steadily increasing. On the seaward slope, the redwood (*Sequoia sempervirens*) is the predominating tree, though many other species occur. The Sierra Nevada mountains again, are heavily forested on their western slopes, the species being arranged in zones according to altitude, and consisting chiefly of pines and firs. Finally, unsuited as Southern California may seem to be to tree growth, above 4000 to 5000 feet, valleys, cañons and protected slopes possess important woodlands of pines and firs.

## Polar.

**Plant Formations in Eastern Greenland.**—In *Meddelelser om Grønland*, xlix., Mr. Chr. Kruuse gives an account of an expedition made by him to Angmagsalik in Eastern Greenland for the purpose of studying the plant formations of the ice-free coastal region. By means of a motor boat the flora of the coast was investigated within a district extending from lat. 65° 30′ to 67° 20′, so that the region lay just about the Arctic Circle. Here, though as compared with the Antarctic region the phanerogamic flora is exceedingly rich, yet as compared with the con-

ditions which prevail in Norway in similar latitudes, plant life is feebly developed. Vegetation is confined to the narrow ice-free margin of the land, and is here far from being continuous, even in summer. The favourable situations are the lower slopes of the coastal mountains, and the narrow plain at their base. The soil is everywhere deficient in nitrogen, earthworms are absent and mild humus is scanty. On the other hand there is but little peat formation, though heather forms a compact turf over considerable areas. As to the mineral elements of the soil, it is found that granite soils are favourable to plants, because the rock weathers slowly, while amphibolite and gneiss weather so rapidly as to form a loose soil unfavourable to plant life. There is but little clay, but deposits of sand and gravel occur. When *in situ* these form favourable soils, but river and sea-sand here, as usual, are barren soils.

In the summer months the precipitation is very small, and the plants are dependent for their supply of water upon the melting of ice and snow. The lower slopes, where ground water constantly occurs in summer, are therefore favourable, while the upper ones are too dry for plant life. The snowfall is very considerable in winter, but the snow-cover is far from uniform. Wind-swept regions have no snow, or only a thin layer, and the depth of the snow-covering has a very important bearing upon plant life. The slopes do not lose their covering of snow till the end of April, and during that month no starch could be detected in the leaves of plants, so that plant activity does not begin till May.

The author classifies the plant formations into a considerable number of groups. The most interesting of these are the continuous formations, which fall into six classes. The first is the thicket, consisting of a dense growth of bushes, dominating the herbaceous plants which grow between. The bushes consist of willow, juniper, birch, and crowberry, and, though always small, reach a great age, 200 to 300 annual rings having been counted in some cases. Such thickets are only found on slopes sheltered from the foehn gales. The slopes must also be densely snow-covered in winter and have running water over their surface in summer. The importance of the snow-cover is illustrated by the fact that exposed twigs and branchlets are killed during winter, this automatic pruning naturally producing a bushy form of growth.

Where the slopes are very steep, the snow-cover thick, and persisting till June, the running water abundant, the insolation in summer strong, and the shelter from gales complete, the thicket is replaced by the herb slope, a close formation of perennial plants, with or without an intermixture of bushes. On the other hand where sand slopes occur, with a thin winter covering of snow, and without flowing water in summer, grasses predominate, and we have the grass slope. At the foot of the slopes, flat areas, with a high snow-cover, which are moist in early summer, and frequently inundated, form what are called grass fields.

On slopes where there is but little ground-water, though there is deep snow in winter, heather moor occurs. This is characterised by the combination of herbaceous plants and bushes, the herbs sometimes standing higher than the bushes. Finally, on the bird islands we have

moss moor, where the vegetation is made up of mosses and lichens, but the ground is much drier than in the moss tundra of West Greenland.

The other formations described are discontinuous, consisting of scattered plants in regions relatively unfavourable to plant life.

The paper is illustrated by several maps and some fine photographs of the flora, and, as will be seen from the above description, makes it possible to form a fairly complete picture of the summer aspect of the margin of the Greenland ice-cap in the region discussed.

**The Swiss Polar Expedition.**—The successful accomplishment of Dr. de Quervain's crossing of Greenland (cf. p. 479) was announced in the daily press some time ago, and a note in *Petermann's Mitteilungen* gives a few particulars of the journey. A start was made from Torsukatakfiord, which opens into Disco Bay in about 66° N., on June 20. As previously arranged a supporting party accompanied the expedition for the first part of the crossing, and, thanks to the excellent arrangements, a height of 3600 feet was quickly reached. Up to a height of about 5250 feet frozen lakes were found on the surface of the inland ice, one of which broke through with the party, happily without loss of any kind. By July 8 the middle of the inland ice was reached at a height of nearly 7900 feet, but the highest point attained (8364 feet) was not reached until two-thirds of the total distance has been traversed, a fact which leads Dr. de Quervain to suggest that the inland ice has two centres. On the 17th of July the mountains on the east coast came in sight, and were found to constitute a mountainous region lying north of the Sermilik Ice-stream. The highest mountain (about 9085 feet) was named Mount Forel, and the region itself was called Switzerland. On the 21st of July the edge of the ice was reached after a steep descent, and after a long search the depôt left for the party was found. By means of a boat left for the purpose they reached the Danish station on August 1, and were subsequently taken in a steamer to Iceland and so home.

The crossing was thus accomplished in six weeks, and of the twenty-nine dogs taken no less than twenty-six reached the east side in safety. The lowest temperature observed was $-23°$ C. ($-9°$ F.), and the weather throughout was generally favourable, though on the western side the wind was always contrary and brought snow. Only one day was unutilised for marching, on account of a snow storm.

**Koch's Arctic Expedition.**—Captain J. P. Koch is also leading an expedition to Greenland which is to include a crossing of the inland ice. His first season's work included a visit to Iceland to obtain Iceland ponies, and in the October issue of *Petermann's Mitteilungen* we have an account of the party's experiences there. They arrived at Akureyri in the early part of June, and from this port made a journey through the Vatna Jökull district and back again, leaving Akureyri for Greenland at the beginning of July. The account of the journey does not contain anything particularly novel, but gives an interesting account

of the plant life observed, and is accompanied by some fine plates. During its course the ponies were employed in order to gain experience for the Greenland expedition, and fifteen were finally shipped to Greenland with the party.

### General.

**Personal.**—We regret to learn of the sudden and early death of Professor Otto Krümmel, the oceanographer, who was for many years professor of geography at Kiel and latterly at Marburg. His great work was the *Handbuch der Ozeanographie*, of which the two volumes were reviewed here in vols. xxiv. and xxvii. respectively. Professor Krümmel was a member of the International Council for the Study of the Sea, and took an active part in promoting the investigation of the ocean.

## EDUCATIONAL.

**Maps and Map-reading.**—Our recent lists of "Books Received" suggest the increased attention which is now being given to the study of maps in connection with geographical teaching. Among pamphlets, etc., dealing with this subject we may mention specially Professor Dickson's exceedingly useful little book, called *Maps: How they are made and how to read them* (Bacon and Co. Price 6d.). In very small compass this gives a great deal of information of great value to teachers, and the cheapness of the booklet renders it available to all. While some parts of it perhaps suffer from too great compression, we consider the third chapter, entitled "Map-reading," a model of exposition, scarcely a word of which could be spared by the student. The treatment of "Lines of Communication" is especially valuable, putting in simple form the facts which are fundamental for geography, but which are often left to be understood by text book writers, rather than clearly formulated. The account of the chief Land Forms, also, is admirable, though the student of Scottish maps will perhaps be disposed to regret that English examples of these are generally taken, instead of the far bolder types to be found in the Highlands of Scotland. The book is indeed admirably suited to the teacher's purpose, and we recommend it to the notice of all those interested in the subject.

Another publication which, by title at least, falls under the same heading, has reached us in the form of *Philip's Practical Map-Reading Cards* (Geo. Philip and Son), by Herbert H. Goodacre, of which several series have been published. Each series consists of twelve cards, bearing questions and exercises on one side, and worked examples, with diagrams, etc., on the other. The cards do not deal with map-reading in the usual sense, that which involves the visualising of the surface relief, etc., of the ground depicted on a topographical map, for they are intended to be used with the ordinary school atlas. In addition to containing geographical questions of a not infrequent type, they have as a special feature

exercises in distance and area-calculation, the making of sketch-maps, and of diagrams illustrating relative heights of mountains, population of towns, section-drawing, plotting of distributions, and so forth. The area-calculation methods will be found useful by those who have to prepare pupils for the Leaving Certificate examination, and we note with satisfaction that the areas given here are at least natural ones, not wholly artificial, like those favoured by the examiner. The sections given also are bold and rough, designed to bring out some broad general point, which seems the only reasonable method when the progress of the scholar is desired, and the teacher is not merely in search of a scheme for keeping his class occupied without great trouble to himself. We think that the cards, if used intelligently and not with a slavish adherence to the written word, should prove of considerable use. The same publishers have also sent us their *Contour Exercise Book*, by Messrs. Young and Fairgrieve, which consists of a series of exercises in contouring, section-drawing, and so forth, the examples being drawn from examination papers.

Another recent publication which has for its object the development of the visualising faculty of the pupil is a booklet called *Visual Geography*, by Agnes Nightingale (A. and C. Black), which is intended for very young children, and consists of a series of outline drawings illustrating geographical facts. Each drawing is accompanied by a short explanation, and the children are intended to colour the pictures themselves. Both pictures and text seem to us to illustrate the supreme difficulty of getting perfect accuracy combined with great simplicity. In the text we object to the statement that the sun is "overhead" at mid-day (presumably in Great Britain), and that fire and smoke come out of volcanoes. The latter statement is certain to suggest to children that coals or wood are burning in volcanoes. In the drawings also we have such representations as the "Source of a River," where a small stream is seen meandering over a wide flat alluvial plain between very lofty and steep mountains, in a fashion which presents considerable difficulties in interpretation. Drawings from photographs would we think have been safer, and have helped to act as a check upon the artist's imagination. But we have no doubt that the little people will enjoy colouring the plates, and may acquire some useful geographical information in doing so.

## NEW BOOKS.

### EUROPE.

*Old World Places.* By Allan Fea. London: Eveleigh Nash, 1912. *Price* 10*s.* 6*d. net.*

If any of our readers are inclined for a ramble through the highways and byways of the fen country of England—Hertfordshire, Essex, Cambridgeshire, Lincolnshire, etc.—they could not do better than take this book with them as a companion. The author has already won his spurs in literature, and has considerable knowledge of architecture, especially ecclesiastical architecture, and to this he adds much erudite information, historical and legendary, as to the localities

through which he passes. He avoids cities and towns of importance, and confines his itinerary to lesser known villages and localities, but not the less does he succeed in compiling an interesting book. It is profusely illustrated with good photographs.

*Cambridge County Geographies: Perthshire.* By Peter Macnair. *Dumfriesshire.* By James King Hewison. *Renfrewshire.* By Frederick Mort. All with Maps, Diagrams, and Illustrations. Cambridge University Press, 1912. *Price* 1*s.* 6*d. net each.*

Among the large number of volumes of this series which have been recently issued we select these three as of special interest to Scottish readers. As a first point of criticism we may note that the plan of the volumes seems to have been so very strictly laid down that little room is left for the individual idiosyncrasy of each author to display itself. The general editor has rightly and naturally chosen his contributors among workers in various subjects, but the framework of the series seems to have been kept too rigid to allow the individuals space to express themselves fully on the subjects upon which they are best qualified to speak, while compelling them to write in some detail on others apart from their normal sphere of interest. For example, in all three volumes we have a brief general discussion of the principles of geology, but a comparison between Mr. Macnair's pages and those of Mr. Hewison suggest, as one would expect, that the one author is dealing with matters with which he is perfectly familiar, while to the other the subject represents a bypath as compared with those to which most of his attention has been devoted. Again, Mr. Macnair discusses such subjects as the origin of the lakes and river valleys of Perthshire—matters of great interest in regard to which information is as yet not easy to obtain. He is here, however, tantalisingly brief, and we feel that a more elastic scheme would have given space to individual authors to enlarge upon such special topics, and would have increased the value of the series as a whole. Curiously enough, another large series with the name of Cambridge attached, "The Cambridge Natural History," errs in precisely the opposite direction, for there no common principle is discernible in the separate volumes. Is there no middle way?

But to this general grumble we must add a word of praise for the three volumes named above. They are obviously the fruit of careful and painstaking investigation, and will greatly aid the student of Scottish geography. As one would expect, Mr. Mort's *Renfrewshire* volume keeps the needs of educationalists well in view, and it may be cordially recommended to the notice of teachers.

*A Junior Geography of Scotland: Regional and Practical.* By David Frew. London: Blackie and Son, Ltd., 1912. *Price* 1*s.*

This is a nicely printed and well-got-up little book, illustrated by some good sketch-maps. The text seems, however, to leave something to be desired in the way of arrangement. There is a great deal of repetition, and many statements that are certain to give rise to misconception. The whole section on the build of Scotland seems to us very unfortunate in its phrasing, and the assertion, in the discussion on rocks, that "the earliest of all, the volcanic rocks, come under the rest. Above these are the oldest rocks, that have been laid down in layers," a statement which is illustrated by a map in which the Tertiary volcanic rocks of Skye are shown by the same shading as the granite masses of the Highlands, would, we are afraid, rather shock a geologist. The geological map further

slumps together Archaean, Cambrian, and Silurian beds with the Highland Metamorphic Series as "Very Old Rocks," names the Coal Measures and Old Red Sandstone beds separately, and includes all remaining sedimentary beds as "Other Old Rocks." It is difficult to understand what meaning such a map can convey to the pupil for whom the book is intended.

*Macdonald's Tourists' Guide to Scotland.* Illustrated. In five divisions. New and Revised Edition. Edinburgh: William Macdonald and Co., 1912. *Price 2s. net.*

This handy little book consists of five sectional guides, each complete in itself but bound together in one volume, and contains a large amount of information at a modest outlay. The style is journalistic, and owing to the number of places mentioned details in regard to individual excursions are not very fully given, and would require to be supplemented on the spot, but those who require a summary account of the attractions of Scotland will find it here.

*Langholm as It Was.* By John Hyslop, J.P., and Robert Hyslop. Sunderland: Hills and Company; London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd.; Edinburgh and Glasgow: John Menzies and Co., Ltd.; Langholm: Robert Scott, 1912. *Price 7s. 6d. net.*

A pathetic interest is attached to this book, as Mr. John Hyslop, who is described in the dedication as its inspirer and principal author, did not live to see its publication. Both Mr. Robert Hyslop and his father are well known as antiquarians and archaeologists, and unquestionably *Langholm as It Was* will increase their already well-earned reputation. At first it might seem as if this book would appeal to but a limited circle of readers, *i.e.*, to those interested in the lovely district of Eskdale and Liddesdale, but a perusal of it shows that it is of great interest to many, indeed, we might say, to all patriotic Scots. Eskdale and Liddesdale form the typical Border district. Its natural beauties command the admiration of the artist and the tourist. Its very name at once conjures up memories of St. Patrick, St. Columba, St. Bridget, St. Mungo, in connection with our early Christianity; of the Douglases, the Maxwells, the Scotts, etc., in the turbulent days when the great Barons never hesitated to defy royal authority on either side of the border; of the Elliots, the Armstrongs, the Johnstones, and other notable reivers of the debatable land, who pillaged their neighbours impartially as necessity or opportunity presented itself, and

> "Who stole the beeves that made their broth
> From England and from Scotland both";

of Law, Hislop, and Peden in the dark days of the Covenanters, when Claverhouse and Johnstone scoured the hills and the valleys in the search for victims. The compilers of this book have gone about their task with praiseworthy patience and erudition, so that in their hands almost every bridge, village, kirk, etc., in the district contributes its quota to the interesting tale. Not the least interesting parts of the book are the extracts from old ecclesiastical, historical, and legal documents which throw a bright light on the conditions of life in the times to which they refer. Add to this, that, as might be expected from experienced archaeologists and antiquarians, we have learned, but by no means dry-as-dust or dogmatic, disquisitions on the local ethnology, geology, and archaeology. Throughout the whole work there runs an eloquent vein of personal enthusiasm and affection for the locality, which, being combined with accurate knowledge, commands and, indeed, compels the reader's attention. The book is a substantial

one, containing nearly 900 pages, and deals with only a small district, but in the skilful hands of Mr. Hyslop and his father the interest never flags, and the variety of subject and treatment is such that the story never becomes monotonous. Part IV. contains reminiscences of the late Mr. John Hyslop, who began life in the reign of George IV. He tells many a good story and takes an honourable place in the ranks of such distinguished raconteurs as Dean Ramsay, Sir Archibald Geikie, Dr. Kerr, etc., and we hope that his son may be able to accomplish the project of publishing another volume of his father's reminiscences which he hints at in his preface. The book is profusely illustrated, and there are several interesting maps.

*The County Coast Series: The Sussex Coast.* By IAN C. HANNAH. London: Fisher Unwin, 1912. *Price* 6*s. net.*

This is Vol. VII. of the above now well-known series, and is a worthy successor to the volumes that have already appeared. Following the lines of earlier volumes of the series, it deals chiefly with historical and literary associations, and although it is rather a readable account of the district than strictly a guide-book, the index provided is so full that the volume would be very helpful to any one actually visiting Sussex. There are numerous and beautiful illustrations of Chichester, Bognor, Worthing, Brighton, Newhaven, etc., and some capital stories exemplifying the characteristic qualities of the natives of "the villages on the plain."

*Rambles in Florence.* By G. E. TROUTBECK. London: Mills and Boon, 1912. *Price* 6*s.*

To those who find Baedeker too cold and prosaic a guide to a city like Florence, which Dante extolled as "famosissima e bellissima figlia di Roma," a book like this comes as a pleasure and a relief. It gives us all the information the tourist wants, and Baedeker contains, but with a charm which the thoroughly practical German does not possess. It contains also beautiful illustrations, some daintily coloured, which enhance its value. Perhaps geographers will miss allusions to the physical and commercial origins of Florence which a recent writer so skilfully explained. We should also like to have heard more of Raphael's Florentine period, for, after all, he, Michael Angelo, Leonardo da Vinci, Dante, and Savonarola are the eternal glories of the fair city on the Arno. An index and a map would have completed a volume of much attractiveness, and written evidently with much knowledge.

## ASIA.

*Men and Manners of Modern China.* By the Rev. R. J. MACGOWAN. London: T. Fisher Unwin, 1912. *Price* 12*s.* 6*d. net.*

Mr. Macgowan is a missionary who has seen fifty years of service in China, and, as he tells us in his preface, has mingled with every class of the people, so that he speaks as one having authority. He is also well known as a writer on matters connected with the country of his adoption. The contents of the present volume, with the exception of its final chapter on the new China, have appeared in the shape of articles in the *North China Herald.* These were afterwards published in book form in China under the title of *Lights and Shadows of Chinese Life*, so that they now see the light for a third time, and naturally they have no direct bearing upon the course of the new movement which is turning the eyes of the world towards China. But those whose interest or curiosity about the

country is sufficient to induce them to read Mr. Macgowan's book will find in him a trusty and faithful guide to much that is strange and fascinating in the lives of an old-world people. The illustrations, from photographs, appear to be well chosen.

*In Forbidden China.* By Vicomte D'Ollone, Major in the French Army. London: T. Fisher Unwin, 1912. *Price* 15*s. net.*

We welcome the translation of *Les Derniers Barbares* reviewed in this *Magazine* last year. The numerous illustrations which accompanied the original work are excellently reproduced, and the translation, which is well done, will enable readers not familiar with French to follow the Vicomte D'Ollone's spirited journey of 5000 miles (of which 1670 were through previously unknown country) with the interest it so thoroughly deserves.

*Narrative of the Visit to India of their Majesties King George V. and Queen Mary, and of the Coronation Durbar held at Delhi, 12th December* 1911. By the Hon. John Fortescue. London: Macmillan and Co., Limited, 1912. *Price* 10*s.* 6*d. net.*

This handsome and beautifully illustrated volume contains the official record of the famous visit of the King-Emperor and the Queen-Empress to India in the winter of 1911-12. It is suitably prefaced by a brief sketch of the early history of the continent: the bulk of the book is devoted to an account of the voyage, a record of what their Majesties saw and did on their way to India, while there, and on the way back. The story is so recent and has been so frequently and successfully brought before the public, that it is unnecessary for us to go over it again. It is enough to say that Mr. Fortescue has performed his task with conspicuous good taste and much tact, with a due sense of proportion, and with the generous enthusiasm and whole-hearted loyalty which were appropriate to it. He successfully avoids gush and high-falutin', and his style is a happy amalgam of simplicity and dignity. To all who desire to possess a memento of the auspicious and unique event we commend this volume as excellent in every way.

## AFRICA.

*Nigeria and its Tin-Fields.* By Albert F. Calvert. London: Edward Stanford, 1912. *Price* 4*s.* 2*d. post free.*

We reviewed here in vol. xxvii. (1911), p. 219, Mr. Calvert's first volume on this subject. He states in his preface that the rapid exhaustion of the edition of this book has led him to prepare the present "larger and more leisurely volume on the same subject." The general features of the book remain the same, but testimony is borne to the rapidity with which the mining industry is developing in Nigeria. The book, as before, is illustrated by a large number of reproductions of photographs, but we should urge upon the author the necessity of including, in the next issue, a Table of Contents and an Index.

*Lybia Italica: Terreni ed Acque, Vita e Colture della Nuova Colonia.* Per Vinassa de Regny, della R. Università di Parma. Milano: Ulrico Hoepli, 1913. *Price l.* 7.50.

Lybia Italica is otherwise Tripolitania and all it embraces. This is the latest word on Italy's new colony, and as such will be read with much interest. The author speaks with authority, for he has made a special study of the subject, and

visited the country at a time when travel was neither easy nor safe. After describing its features in detail, his conclusion for the future is that it is not an Eldorado, and he is thankful for that, but that it is a country full of promise for the hard-working and thrifty Italian peasant. With reference to the important subject of water supply, he considers that there will be sufficient for all needs. He dwells upon the ample underground accumulation which with improved methods can be tapped for the use of cattle and crops. The Roman remains show that they depended on two sources for their water, firstly, this accumulation, and, secondly, the heavy winter rainfall, to catch which they built numberless dykes. The author holds that what the Romans effected with the limited means at their hand, the modern Italian may surely do. He holds very enlightened views on the subject of re-afforestation as a means of improving the climate and providing timber for the colonists. The book is marred by a tone of strong political bias, but we need not go into that here. We admire the spirit in which Italy is entering into this work of civilisation, and we wish her all success. The illustrations and maps are excellent.

*A Colony in the Making.* By Lord Cranworth. London: Macmillan and Co., Limited, 1912. *Price* 12*s. net.*

British East Africa is the colony the conditions of which are described by Lord Cranworth in the very interesting volume now before us. He has qualified himself for the task by long residence in the colony, and his hope in writing is "that some slight idea may be obtained of the climate, of the sport, of the possibilities of gain and recreation in the Highlands of East Africa." At a very early stage in his book he points out that although the total area of the Protectorate is as great as that of France and Great Britain taken together, yet for one cause and another the whole area available for colonisation is only about ten million acres: but of this he says that "at the present day it offers prospects to a certain type of colonist that can be nowhere excelled, if, indeed, they can be equalled." The advantages which the colony has to offer are an excellent climate, rich soil, the greater part of which can be cropped twice in one year, abundant grazing, plenty of water, splendid forests, abundant labour, good communications and grand sport, both shooting and fishing. The drawbacks are the distance from home and markets, the absence of minerals, the presence of various insect plagues and pests, and the want of educational facilities. It will be seen that, from the nature of things and as the colony develops, the most of these drawbacks will, in course of time, be very greatly ameliorated, and some may disappear altogether. The greater part of the book is taken up with disquisitions on each of the subjects mentioned above, and in addition to this we have several chapters devoted to a thoughtful and discriminating description of the character and capacities of the indigenous tribes and races, of which, we may say, that Lord Cranworth often takes a very different view from some other authorities. He willingly recognises the good qualities of the natives, but he plainly points out their limitations, and he deprecates the preferential treatment they often receive at the hands of a paternal government. To the intending emigrant he has much interesting and useful information to give, as to the crops best suited for the soil, the management of live stock, etc., and he cordially acknowledges the good work done by Lord Delamere and the first settlers, and latterly by the Agricultural Department of the Government in the development of the colony and in disseminating information as to its resources. It would be unreasonable to expect any new matter in the chapters devoted to sport, but we must add that Lord Cranworth is a true sportsman, having the interests of the wild animals at heart as well as those of the hunter and the colonist. Lady Cran-

worth contributes a chapter containing much useful advice to women emigrants. The colony is unquestionably now advancing steadily and satisfactorily on the high way to prosperity. "Capital is flowing in, and, better still, exports are flowing out." Much credit for this is due to Sir Percy Girouard, the late Governor of the Protectorate, and it is to be hoped that his successors will continue and develop his wise and beneficent policy. We must add that this interesting and instructive book is illustrated with some excellent photographs and also has a useful map.

## AMERICA.

*Venezuela.* By Leonard V. Dalton, B.Sc. (Lond.), F.R.G.S. London and Leipsic: T. Fisher Unwin, 1912. *Price* 10*s.* 6*d. net.*

We are accustomed to look on Venezuela as chiefly characterised by revolutions and unpleasant diplomatic surprises, but in reality it is a country of considerable importance even now, and will probably be more important in the near future. After the long-drawn-out horror of the Spanish domination, it was only when in 1830 that Venezuela finally shook itself free from Colombia that real economic progress commenced. Since then it has had its ups and downs, including the unfortunate interlude of Castro, but now there is every hope of steady improvement. The author prophesies a great future for Venezuela, depending largely on the events following the opening of the Panama Canal. There are two great industries quite undeveloped so far—petroleum and cattle—which will probably become important before long. There are large unexploited sources of petroleum. As Mr. Dalton points out, the weak point about vessels worked by oil is the want of replenishing stations, and it can easily be seen that as Venezuela, when the Canal is opened, will be in touch with one of the world's great highways, its petroleum workings will be in demand. So with cattle—the great upland plains, or *Llanos*, are eminently suited for cattle-raising, an industry practically undeveloped, and it is thought that the Canal will bring the great markets much more within reach than is the case at present. It is pointed out with regard to import and export trade, that America and Germany are getting ahead of us, largely owing to their better methods, and the traders of Great Britain are urged to give this subject their earnest attention.

## GENERAL.

*The Work of Rain and Rivers.* By T. G. Bonney, Sc.D., LL.D., F.R.S.

*The Civilisation of Ancient Mexico.* By Lewis Spence.

*China and the Manchus.* By Herbert A. Giles. Cambridge: At the University Press, 1912. *Price* 1*s. net each.*

These three little books are members of one of those series whose issue is one of the striking features of the literary history of the past few years. All are daintily got up, more so perhaps than the similar members of the Home University Library Series; but, on the other hand, they appear to contain considerably less matter.

Of the three named above, the two latter are more concerned with history than geography. Mr. Giles gives a very dramatic account of the rise and fall of the Manchus, ending with the scene when Sun Yat Sen, the president of the provisional republican government, offered sacrifice at the mausoleum of the first sovereign of the Ming dynasty in the spring of this year. Mr. Spence gives most space to an account of the terrible religion of the ancient Mexican people;

but his account is chiefly descriptive, and he says little in regard to the many interesting points which arise in connection with the relation between the Mexican rites and those practised by other semi-barbarous agricultural peoples.

Dr. Bonney's book gives a clear and simple account of the sculpturing of the land by water, marked throughout by an unwillingness to accept the views or the terminology of what may be described as the younger school of physiographers. This leads to a tendency to over-emphasise the importance of water, owing to the exclusion from the discussion of the other agents which have helped to modify the surface. One of the interesting features of the book is due to the author's extensive travels, which enable him to give examples of phenomena from many different parts of the world. Sometimes, however, he has omitted to revise statements which, though doubtless true at the time of his visit, have ceased to be so. Thus Ravenna's "malarious marshes" are now rice-fields, and the church of Apollinare in Classe is so far from standing in "mournful solitude" that it has a thriving sugar-beet factory close beside it. The argument also derived from the subsidence of the pavement in Theodoric's Mausoleum would at least be modified by another visit to the town, for recent excavations have shown that every ancient building in and near Ravenna shows signs of subsidence in the presence of old pavements beneath the existing floors. Whatever the explanation of this, we do not think that the discussion of the phenomenon in the text is adequate.

*Essentials of World Geography for Junior Students.* By J. F. Unstead and E. G. R. Taylor. London: Geo. Philip and Son, 1912. *Price* 2*s.*

This book, which is on similar lines to the same authors' *General and Regional Geography for Teachers and Students*, gives an elementary account of physical geography in the broad sense, including biogeography and anthropogeography. It is copiously illustrated by maps and simple diagrams. In the section on the Natural Regions the chief cities of the world are mentioned, with notes on their trade, so that although the book deals primarily with the physical side of the subject, political facts are not altogether omitted, and the elements of commercial geography are also discussed. The book might thus be very well used towards the end of an elementary course on world geography, when it could be employed both to revise known facts and to impart new ones. It is indeed intended to be used for this purpose in elementary schools, as well as to serve as an introduction to advanced geography in the higher forms of secondary schools. For both these purposes it seems well suited, the treatment being thoroughly modern.

*A Tramp's Sketches.* By Stephen Graham. London: Macmillan and Co., 1912. *Price* 5*s.*

One finds no inconsiderable pleasure in reading this book, for the subject-matter is of much interest, and the writing so well done, that it may fairly claim to be called literature. Mr. Graham is no lover of the town, and these sketches in effect preach revolt against the commercialism that takes first place in men's lives to-day. They treat of his pilgrimage to Jerusalem by way of the Caucasus and the Black Sea, and among a people who even in this year 1912 will give hospitality to the pilgrim "for the love of God," being as yet unspoiled by the worship of Mammon. The glory of the open air is met with on every page, the word-painting is exquisite, and any one who has slept under a starry sky will delight in Mr. Graham's experiences, his comforts and occasional discomforts.

In the Wanderer's Tale—an epitome of his creed under an allegorical guise—Mr. Graham speaks out with remarkable power, and yet with as remarkable

charm, the faith that is in him: and if we do not agree with all his views, we can appreciate none the less his earnestness.

*Cambridge Geographical Text-Books: Intermediate.* By A. J. Dicks, B.A., B.Sc. Cambridge: At the University Press, 1912. *Price* 3*s.*

This book is intended for the pupils of the middle forms of secondary schools, and covers the ground required for the University Junior Local Examinations. It begins with chapters on mathematical geography, land and water, climate, and the distribution of life, which are somewhat perfunctory in character, and then goes on to describe the continents in order. There are a number of illustrations and a few maps and diagrams, but we see nothing very striking about the book to distinguish it from others of similar type. We have noticed several minor errors: fallow deer are not wild in Britain, the linen industry in Scotland does not depend upon home-grown flax, the opossum does not occur in Australia, the tapir of South America does not represent the elephant of the Old World, and so on.

## BOOKS RECEIVED.

*Forfarshire* (Cambridge County Geographies). By Easton S. Valentine, M.A. With Maps, Diagrams and Illustrations. Cr. 8vo. Pp. viii + 160. *Price* 1*s.* 6*d. net.* Cambridge: University Press, 1912.

*A Book of Discovery: The History of the World's Exploration, from the Earliest Times to the finding of the South Pole.* By M. G. Synge, F.R.Hist.S. Fully Illustrated from Authentic Sources and with Maps. Cr. 4to. Pp. xxvii + 554. *Price* 7*s.* 6*d. net.* London: T. C. and E. C. Jack, 1912.

*Dawn in Darkest Africa.* By John W. Harris. With an Introduction by The Right Hon. the Earl of Cromer, O.M., G.C.B., G.C.M.G., K.C.S.I. With Illustrations and a Map. Demy 8vo. Pp. xxxvi + 308. *Price* 10*s.* 6*d. net.* London: Smith, Elder and Co., 1912.

*The Flowing Road, adventuring on the Great Rivers of South America.* By Caspar Whitney. With Maps and Photographs by the Author. Demy 8vo. Pp. 319. *Price* 12*s.* 6*d. net.* London: William Heinemann, 1912.

*The Land that is Desolate: An Account of a Tour in Palestine.* By Sir Frederick Treves, Bart., G.C.V.O., C.B., LL.D. With 43 Illustrations from Photographs by the Author and a Map. Sm. Ry. 8vo. Pp. viii + 287. *Price* 9*s. net.* London: Smith, Elder and Co., 1912.

*The Malay Peninsula: A Record of British Progress in the Middle East.* By Arnold Wright and Thomas H. Reid. With a Map and 51 Illustrations. Demy 8vo. Pp. 360. *Price* 10*s.* 6*d. net.* London: T. Fisher Unwin, 1912.

*The Progress and Arrest of Islam in Sumatra.* By Gottfried Simon. With an Introductory note by Samuel M. Zwemer, D.D., F.R.G.S. Demy 8vo. Pp. xxiv + 328. *Price* 6*s. net.* London: Marshall Brothers, Ltd., 1912.

*Papua or British New Guinea.* By J. H. P. Murray. With an Introduction by Sir William MacGregor, G.C.M.G., C.B., D.Sc., LL.D. With 38 Illustrations. Demy 8vo. Pp. 388. *Price* 15*s. net.* London: T. Fisher Unwin, 1912.

*Through Shên-Kan: The Account of the Clark Expedition in North China.* By Robert Sterling Clark and Arthur de C. Sowerby. Edited by Major C. H. Chepmell. Cr. 4to. Pp. 247. *Price* 25*s. net.* London: T. Fisher Unwin.

*Highroads of Geography* (The Royal School Series). Books iv. and v. *Prices* 1*s.* 6*d.* and 1*s.* 8*d.* Demy 8vo. Pp. 300 each. Edinburgh: T. Nelson and Sons, 1912.

*The Holy City: Benares.* With 58 Illustrations and a Map. By RAJANI RANJAN SEN, B.A., B.L. Cr. 8vo. Pp. ix + 280. *Price Rs.* 3. Chittagong: M. R. Sen, 1912.

*Smiling Benâres.* Containing a Sketch from the Vedic Days to the Modern Times. With many Illustrations, and a Map of Benares and its Environs. K. S. MUTHIAH AND CO., Benares City. Cr. 4to. Pp. 166. Madras: Raitby and Co., 1911.

*The Botany of Iceland.* Edited by L. KOLDERUP ROSENVINGE, Ph.D., and EUG. WARMING, Ph.D., Sc.D. Part I. The Marine Algal Vegetation. By HELGI JÓNSSON, Ph.D. Demy 8vo. Pp. 186. Copenhagen: J. Frimodt, 1912.

*Livingstone and the Exploration of Central Africa.* By Sir H. H. JOHNSTON, G.C.M.G., K.C.B., D.Sc., F.R.G.S., F.Z.S., etc. With numerous Illustrations. 12mo. Pp. viii + 372. *Price* 1*s. net.* London: George Philip and Son, Ltd., 1912.

*Die Geographische Entwicklung des Rheindeltas bis um das Jahr* 1500*: eine Historisch-Geographische Studie.* Von ARNOLD NORLIND. Demy 8vo. Pp. xviii + 272. *Preis* 5 *Mk.* Lund: Gleerupsche Univ.-Buchhandlung, 1912.

*Madeira.* Illustrated by ANDREW PICKEN, with a Description of the Island. Edited by Dr. JAMES MACAULAY, M.A. Royal folio. *Price* £2, 2*s.* London: Day and Hayes, 1842. Presented by Chas. Boog-Watson, Edinburgh.

*A Holiday Trip to Canada.* By MARY J. SANSOM. Cr. 8vo. Pp. 120. *Price* 2*s. net.* London: St. Catherine's Press, 1912.

*The Adventures of an Elephant Hunter.* By JAMES SUTHERLAND. With Illustrations. Demy 8vo. Pp. xviii + 324. *Price* 7*s.* 6*d. net.* London: Macmillan and Co., Ltd., 1912.

*British Somaliland.* By RALPH E. DRAKE-BROCKMAN, M.R.C.S.Eng., L.R.C.P.Lond. With 74 Illustrations from Photographs on Art Paper, other Illustrations, and a Map. Demy 8vo. Pp. xvi + 334. *Price* 12*s.* 6*d. net.* London: Hurst and Blackett, Ltd., 1912.

*Verbreitung, Ursprung, Eigenschaften und Anwendung der Mittelschwedischen Boden. Führer einer Agrogeologischen Exkursion.* Von GUNNAR ANDERSSON und HENRIK HESSELMAN. Mit 4 Karten in Farben, 50 Kartenskizzen, Profilen und Figuren. Demy 8vo. Pp. 156. Stockholm: A.-B. Nordiska, 1910.

*Notes and Queries on Anthropology.* Fourth Edition. Edited for the British Association for the Advancement of Science. By BARBARA FREINE-MARRECO and JOHN LINTON MYRES. Cr. 8vo. Pp. x + 288. *Price* 5*s.* London: The Royal Anthropological Institute, 1912.

*Bengal District Gazetteers: Hoogly and Jessore.* By L. S. S. O'MALLEY. Calcutta, 1912.

*Eastern Bengal and Assam District Gazetteers: Rangpur.* By J. A. VAS, B.A., LL.B. Allahabad, 1912.

*Central Provinces District Gazetteers: Amraoti District.* Edited by S. V. FITZGERALD and A. E. NELSON. Bombay, 1911.

*Burma Gazetteer: Margai District.* Compiled by G. P. ANDREWS, I.C.S. Rangoon, 1912.

*District Gazetteers of the United Provinces of Agra and Oudh.* Vols. IX., XIII., and XXXV. Allahabad, 1911.

*Census of India,* 1911. Vol. XI. Coorg Report and Tables. *Price* 1*s.* 6*d.* Madras, 1912.

*Census of India,* 1911. Vol. XII. Madras. Pt. 1, Report; Pt. 2, Imperial and Provincial Tables. *Price* 3*s.* 6*d. each.* Madras, 1912.

*Publishers forwarding books for review will greatly oblige by marking the* **price** *in clear figures, especially in the case of foreign books.*

# ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

## REPORT OF COUNCIL.

### TWENTY-EIGHTH SESSION, 1911-1912.

The Council has the honour to submit the following Report :—

#### ORDINARY MEMBERSHIP.

The changes which occurred during the Session in the number of members were as follows :—

| | | |
|---|---|---|
| Number on 1st October 1911, | | 1996 |
| New Members added, | | 54 |
| | | 2050 |
| Deduct by Death, | 31 | |
| „ Resignation, | 120 | |
| „ Arrears, | 1 | |
| | | 152 |
| Number of ordinary members remaining on roll on 30th September 1912, | | 1898 |

Of this number, 999 are on the Edinburgh list, 471 are on the Glasgow list, 158 and 123 are on the Dundee and Aberdeen lists respectively. In addition to those on the lists named, 45 members reside abroad, and 102 reside in England. The number of life members in the total given above is 229.

#### TEACHER ASSOCIATE MEMBERS.

| | | |
|---|---|---|
| Number on 1st October 1911, | | 154 |
| New Members added, | | 39 |
| | | 193 |
| Deduct by Resignation, | 27 | |
| | | 27 |
| Number of Teacher Associate members remaining on roll on 20th July 1912, | | 166 |

#### MEETINGS OF THE SOCIETY.

The Society's Anniversary Meeting was addressed by Dr. Fridtjof Nansen, G.C.M.G. Thirty-nine ordinary meetings were held, nine in Edinburgh and ten in Glasgow, Dundee, Aberdeen. These meetings were addressed by Captain C. G. Rawling, C.I.E., F.R.G.S. ; Major Leonard Darwin, D.Sc., Vice-President, late President R.G.S. ; Mr. W. H. Shrubsole, F.G.S. ; Mr. J. Y. Buchanan, F.R.S. ; Sir Percy Cunynghame, Bart. ; The Rt. Hon. Sir George H. Reid, K.C.M.G. ; Mr. H. M. Cadell, B.Sc., F.R.S.E. ; Mr. G. de Hochpied Larpent, B.A. (Cantab.) ; Prof. D. T. MacDougal ; Lieut.-Colonel the Hon. Sir Newton James Moore, K.C.M.G. ; Mr. J. A. J. de Villiers ; Mrs. J. W. Henshaw ; the Very Rev. Dean Sloman ; and Mr. W. Herbert Garrison, F.R.G.S.

### Medals Awarded.

The Society's Gold Medal was conferred on Mr. J. Y. Buchanan, F.R.S., for his distinguished services to Geography and Science, especially in connection with oceanographical research.

### Death of Mrs. Livingstone Bruce.

The Council has recorded in the following terms its appreciation of the services rendered by her to the Society :—

> "The Council expresses its profound regret and great sense of loss at the death of Mrs. Livingstone Bruce. It records its high appreciation of all that she did for the Society, especially her invaluable services in conjunction with her late husband at the founding of the Society, and also her gift of the Livingstone Medal in memory of her distinguished father, Dr. Livingstone. During the past twenty-eight years of the Society's existence, she cherished all its interests, and was always ready to extend her generous hospitality to the distinguished travellers who from time to time came to Edinburgh under the Society's auspices."

### Geographical Association (Association of Scottish Teachers of Geography.)

Under the auspices of this Society an Association composed of teachers of Geography in Scotland has been formed. Its objects are to provide a means of discussing such problems as may arise in connection with the status of this subject and generally to promote the teaching of Geography on modern lines.

### Scotch Education Department and the Teaching of Geography in Secondary and Higher Grade Schools.

Representations were made to the Scotch Education Department with regard to the circular issued by them in which they state that written papers in history and geography will no longer form an integral part of the examination in English in the Post-Intermediate stage, and that the written examinations in history and geography should accordingly be taken only by candidates who have given these subjects very particular attention, and who have devoted an adequate amount of time to them in their Post-Intermediate course. This Society joined with the Historical Association of Scotland in pressing upon the attention of the Scotch Education Department the serious consequences of this step for the two subjects affected, and in requesting an interview with the Secretary to the Department. This request was granted, and at the interview, which took place at the Scotch Education Office, Sir John Struthers, in reply to the representations put forward by the members of the deputation delegated by the above mentioned bodies, stated that, while the Department were unable to make any immediate change in the regulation referred to, the question of making changes favourable to the position of geography in the intermediate stage would be carefully considered.

### Lighting by Electricity of the Society's Library, Council Room, and other Rooms.

The Edinburgh City Corporation have agreed to light the rooms by electricity, and the installation will be ready for use at the end of November.

### Diploma of Fellowship.

There are at present forty-eight Honorary Fellows and one hundred and fourteen Ordinary Fellows of the Society.

During the session the ordinary Diploma of Fellowship was awarded to Robert Blyth of Balvonie; Adam Patterson Gray, M.A., and James Hutcheon, M.A., members of the Society.

### Corresponding Members.

Dr. Francis P. Moreno, Founder and Director of the La Plata Museum, was appointed a corresponding member of the Society. The corresponding members number forty-seven.

### The Society's Magazine.

The *Scottish Geographical Magazine* has, as usual, been published throughout the past session monthly, with maps and illustrations.

The Council is glad to acknowledge its obligations to the contributors of articles, and to the following gentlemen who have rendered valuable assistance to the editors:—Dr. J. G. Bartholomew; Dr. R. N. Rudmose Brown; Dr. W. S. Bruce; Mr. H. M. Cadell; Mr. Geo. G. Chisholm; Mr. James Cossar; Dr. A. S. Cumming; Rev. A. K. Dallas; Mr. H. B. Finlay; Prof. J. W. Gregory; Sir Philip Hamilton Grierson; Mr. N. Miller Johnston; Mr. Jas. Macdonald; Rev. R. Mackenzie; Mr. D. MacRitchie; Mr. J. D. Monro; Mr. T. S. Muir; Mr. Ralph Richardson; Dr. J. S. Shand; Mr. Mellis Smith; Prof. J. A. Thomson; Mr. James Watt; Dr. Wigner; Mr. R. Wilkie; Mr. W. B. Wilson.

### Library and Map Department.

During the past session 310 books, 54 pamphlets, 359 reports, 21 atlases, 361 map-sheets and charts have been added to the library. The number of volumes borrowed by members was 3736, and the library was, as usual, much consulted by non-members in search of geographical information.

The Council desires to record its thanks to foreign and colonial governments for the official publications they have presented to the library; to the Treasury, for the revised Ordnance Survey Maps of Scotland, both in outline and colour, as each of the revisions now in progress is published; to the British Museum (Natural History), the Edinburgh University Library, and the Royal Society of Edinburgh; and also to the undermentioned private donors of books and maps, viz.:—Colonel F. Bailey, LL.D.; Dr. J. G. Bartholomew; Dr. J. W. Bews, M.A.; Sir Charles Bruce, G.C.M.G.; Dr. W. S. Bruce; Dr. C. B. Crampton; Mr. W. Caldwell Crawford, jr.; Mr. Reginald A. Daly; Major F. G. Guggisberg, C.M.G.; Mr. R. W. Hall; Mr. N. Miller Johnston; Major-General J. de Schokalsky; Mr. W. H. Shrubsole; Sir M. Aurel Stein, K.C.I.E.; Mr. W. Stevenson; Prof. E. Oberhummer; Prof. Otto Nordenskjöld; Mr. Samuel Turner, F.R.G.S.; Prof. Eug. Warming; and the late Mr. Edward Whymper.

### Glasgow, Dundee, and Aberdeen Centres.

The Council has again the pleasure to acknowledge the services rendered by the honorary officials of the Glasgow, Dundee, and Aberdeen centres for their continued successful conduct of the business of the Society.

### Finance.

The Council begs to submit the Annual Financial Statement.

# ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

*From 1st October 1911 to 30th September 1912.*

| | | | |
|---|---|---|---|
| FUNDS AT CLOSE OF LAST ACCOUNT:— | | | |
| £1000 Glasgow and South-Western Railway Company 4 per cent. Debenture Stock, at cost price, as at 29th May 1885, | | £1102 19 9 | |
| £533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost price, as at 30th December 1890, | | 496 2 0 | |
| £200 Great Central Railway Company 4½ per cent. Debenture Stock, at cost price, as at 31st December 1898, | | 312 2 9 | |
| £240 North British Railway Company 4 per cent. Consolidated Preference Stock, No. 1, at cost price, as at 11th December 1902, | | 306 8 9 | |
| £400 Dominion of Canada 3½ per cent. Registered Stock, 1930-50, at cost price, as at 9th March 1911, | | 405 1 0 | |
| | | £2622 14 3 | |
| BALANCE due by Banks:— | | | |
| On Account Current, | £53 7 8 | | |
| On Deposit Receipt, | 304 19 5 | | |
| On Do. do. (Glasgow Equipment Fund) | 60 19 7 | | |
| | £419 6 8 | | |
| *Less* due to Treasurer, | 0 2 6 | | |
| | | 419 4 2 | |
| | | £3041 18 5 | |
| *Less*—Subscriptions received applicable to Sessions 1911-12 and 1912-13, | | 12 12 0 | |
| | | £3029 6 5 | |
| SUBSCRIPTIONS from Ordinary Members, | £1810 4 0 | | |
| *Less*—Applicable to Sessions 1912-13 and 1913-14, | 11 11 0 | | |
| | £1798 13 0 | | |
| SUBSCRIPTIONS from Life Members, | 20 0 0 | | |
| SUBSCRIPTIONS from Associate Members, | £94 10 0 | | |
| *Less*—Applicable to Session 1912-13, | 0 10 6 | | |
| | 93 19 6 | | |
| FEES received for Society's Diploma, | 9 9 0 | | |
| DIVIDENDS and INTERESTS, | 101 1 8 | | |
| GOVERNMENT GRANT, | 240 0 0 | | |
| MISCELLANEOUS, | 5 3 0 | | |
| ENTRANCE FEES from new Members, | £36 15 0 | | |
| *Less*—Applicable to Session 1912-13, | 0 10 6 | | |
| | 36 4 6 | | |
| | | 2261 13 8 | |
| | | £5294 0 1 | |

| | | | |
|---|---|---|---|
| MAGAZINE—Expenses of Publication, etc., for Nos. 10 to 12 of Vol. XXVII., and Nos. 1 to 9 of Vol. XXVIII.:— | | | |
| Printing and other charges, | | £657 6 2 | |
| Illustrations, | | 75 18 7 | |
| Maps, | | 87 6 3 | |
| | | £820 11 0 | |
| *Less*—Magazines sold, | £65 17 6 | | |
| Advertising Receipts, less Payments, | 94 16 11 | | |
| | | 160 14 5 | |
| | | £659 16 7 | |
| GENERAL PRINTING, | | 30 9 4 | |
| BOOKS and other furnishings for Library, | | 77 10 10 | |
| EXPENSES in connection with Lectures—*Less* Tickets sold, | | 515 6 4 | |
| RENT OF COUNCIL ROOM, TAXES, Gas, Repairs, Insurance, etc., | | 248 3 5 | |
| GLASGOW BRANCH, Rent of Room, | | 15 0 0 | |
| SALARIES, | | 543 6 6 | |
| MISCELLANEOUS, including Stationery, General Expenses, and Postages, | | 125 18 8 | |
| MEDALS, | | 14 6 6 | |
| | | £2227 18 2 | |
| FUNDS AT CLOSE OF THIS ACCOUNT:— | | | |
| £1000 Glasgow and South Western Railway Company 4 per cent. Debenture Stock at cost price, as at 29th May 1885, | £1102 19 9 | | |
| £533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost price, as at 30th December 1890, | 496 2 0 | | |
| £200 Great Central Railway Co. 4½ per cent. Debenture Stock, at cost price, as at 31st December 1898, | 312 2 9 | | |
| £240 North British Railway Company 4 per cent. Consolidated Preference Stock, No. 1, at cost price, as at 11th December 1902, | 306 8 9 | | |
| £400 Dominion of Canada 3½ per cent. Registered Stock, 1930-50, at cost price, as at 9th March 1911, | 405 1 0 | | |
| | £2622 14 3 | | |
| BALANCE due by Banks:— | | | |
| On Account Current, | £83 7 10 | | |
| On Deposit Receipt, | 304 19 5 | | |
| On do. do. (Glasg. Equipment Fund), | 63 8 8 | | |
| DUE by Treasurer, | 4 3 9 | | |
| | 455 19 8 | | |
| | £3078 13 11 | | |
| *Less*—Subscriptions received applicable to Sessions 1912-13 and 1913-14— | | | |
| Ordinary Members, | £11 11 0 | | |
| Associates, | 0 10 6 | | |
| Entrance Fees, | 0 10 6 | | |
| | 12 12 0 | | |
| | | 3066 1 11 | |
| | | £5294 0 1 | |

*Edinburgh, 25th October* 1912.—I have examined the Accounts of the Royal Scottish Geographical Society for the year ending 30th September 1912, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and I find the whole to be correctly stated and sufficiently vouched and instructed.

P. C. ROBERTSON, M.A., C.A., Auditor.

## LIVINGSTONE MEDAL FUND.

FUNDS AT CLOSE OF LAST ACCOUNT:—

| | | | |
|---|---|---|---|
| £770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price, | £999 | 11 | 6 |
| Deposit Receipt, | 19 | 9 | 9 |
| | £1019 | 1 | 3 |

INCOME RECEIVED—

| | | | |
|---|---|---|---|
| Dividend on £770 North British Railway Company 4 per cent. Preference Stock No. 1— | | | |
| For one year to 31st January 1912, | 28 | 19 | 8 |
| Bank Interest, | 0 | 7 | 8 |
| Income-tax recovered, | 1 | 16 | 4 |
| | £1050 | 4 | 11 |

FUNDS AT CLOSE OF THIS ACCOUNT—

| | | | |
|---|---|---|---|
| £770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price, | £999 | 11 | 6 |
| Deposit Receipt, | 50 | 13 | 5 |
| | £1050 | 4 | 11 |

*Edinburgh, 25th October* 1912.—Examined and found correct.

P. C. ROBERTSON, M.A., C.A., Auditor.

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Printed by T. and A. CONSTABLE, Printers to His Majesty
at the Edinburgh University Press

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The Scottish geographical magazine

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